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BEESON (C. F. C.). **Carpenter Bees.**—*Indian For.* **64** no. 12 pp. 735–737, 1 pl. Calcutta, 1938.

Bees of the genus *Xylocopa* are sometimes troublesome in bungalows and forest rest-houses in India, boring into roofing rafters, posts and bamboos.

X. latipes, Dru., attacks timber of *Amoora wallichii*, *Dysoxylon hamiltonii*, *Eugenia jambolana*, *Cinnamomum glanduliferum* and *Cedrela toona*, and has been recorded as boring in lead cables. It has four generations a year and hibernates in its tunnels from November to March, even in the warmer parts of India. The eggs, which may also be laid in broken bamboos or reeds, are deposited singly in cells in the tunnel, which are stored with pollen as food for the larvae. In warm moist weather, the latter hatch in 6–7 days and pupate about 3 weeks later. The pupal stage lasts about 15 days, and the adult bores or follows the tunnel out to the surface. *X. tenuiscapa*, Westw., which bores in wood of *Adina cordifolia* and *Eugenia jambolana*, has similar habits, but is active throughout the year in southern India. Other species mentioned are *X. aestuans*, L., *X. dissimilis*, Lep., *X. iridipennis*, Lep., *X. verticalis*, Lep., and *X. auripennis*, Lep.; all of them infest bamboos, and all but the last are also recorded from various kinds of timber.

For control, infested woodwork should be painted with creosote or with fuel-oil thinned with kerosene, preferably with the addition of dichlorobenzene. When the tunnels have been saturated, they should be plugged with wood or cement to prevent reinfestation, and the woodwork should be treated with creosote or linseed oil each year. Tar is not a deterrent after it has dried.

YOKOO (T.). **Some Observations on the Mulberry Gall-midge,** *Diplosis mori* **Yokoyama, in Korea. I.** [*In Japanese.*]—*Ann. agric. Exp. Sta. Chosen* **9** no. 2 pp. 319–337, 1 pl., 4 figs., 13 refs. Suigen, Korea, 1937. **II. Effect of low Temperatures on the Outbreaks.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi* **10** no. 3–4 pp. 153–157. Tokyo, 1938.

In the first part of this paper, an account is given of observations on *Diplosis mori*, Yokoyama, which occurs throughout almost the whole of Korea. The larvae infest the buds of mulberry, causing deformation; they are present in buds from late June to early October, the injury being most severe from July to September. Up to 35·44 per cent. of buds of some varieties were infested in 1936. This Cecidomyiid has 4 or 5 generations a year, and hibernates as a full-fed larva about an inch below the surface of the soil. The adults live for 3–4 days, and females lay 20–50 eggs. The number of larvae observed in a bud was usually 2–7, but ranged up to 19. Soil of which the moisture content was 40–60 per cent. appeared to be optimum for the emergence of adults. No definite relations could be observed between the occurrence of outbreaks and climatic conditions.

In the second part of the paper, it is stated that near Suigen, the percentage of mulberry trees infested by *D. mori* averages 20. The overwintered larvae pupate in May, and the adults emerge in June. Injury is usually serious in seasons following a winter in which the temperatures of the soil surface are lower than usual. The hibernating

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larvae apparently survive temperatures as low as −25°C. [−13°F.]. Low rainfall in winter is generally followed by a reduction in injury. Natural enemies include a Scelionid of the genus *Synopeas*, a Nematode (*Cephalobus* sp.) and a spider.

TAMURA (I.). **Effect of Light upon the Volume of Food taken by positively phototropic May Beetles. I.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi* **11** no. 1 pp. 15–24. Tokyo, 1939.

Adults of *Aserica* (*Autoserica*) *japonica*, Motsch., and *Anomala rufocuprea*, Motsch., which attack the leaves of soy beans and other plants in Japan, generally remain in the soil during the day and feed at night, but those of *A. rufocuprea* also feed on cloudy days. When adults of the latter were kept under conditions of light, the volume of food taken by them decreased with the increase in the intensity of the light. No correlation was observed between light intensity and food consumption in the case of *Anomala cuprea*, Hope, which is diurnal in habit.

AKITA (N.) & TSUCHIYA (K.). **Influence of Chloropicrin on the Respiration of the Larvae of** *Chilo simplex* **Butl.** [*In Japanese.*] —*Oyo-Dobuts. Zasshi* **11** no. 1 pp. 32–36, 1 fig. Tokyo, 1939.

In experiments in Japan, hibernating larvae of *Chilo simplex*, Btlr., that weighed 80–100 mg. were fumigated with chloropicrin at 20 and 25°C. [68 and 77°F.], at which temperatures respiration is most active. It was found that the volume of oxygen consumed by them decreases after fumigation in proportion to the duration of the exposure. All the larvae were killed by fumigation with 100 mg. chloropicrin per litre for 5 and 15 minutes at 25 and 20°C., respectively, and with 50 mg. for 20 minutes at 20°.

WATANABE (C.). **Description of a new Species of the Genus** *Opius* **Wesmael, bred from the Cherry Fruit Fly,** *Euphranta* **sp. (Hymenoptera : Braconidae).**—*Insecta matsum.* **13** no. 1 pp. 35–37, 1 fig. Sapporo, 1938.

Descriptions are given of both sexes of *Diachasma* (*Opius*) *aino*, sp. n., bred from a Trypetid of the genus *Euphranta* that infests cherries in Hokkaido and Honshu. It is a solitary parasite and passes the winter as a mature larva in the host puparium. The adults begin to emerge during early summer, and fly to cherry trees, where the females oviposit in larvae of the Trypetid.

WATANABE (C.). **A Braconid Parasite of** *Porthesia similis* **Fuessly (Host Record of Braconidae, I).**—*Insecta matsum.* **13** no. 1 p. 38. Sapporo, 1938.

Microplitis cerurae, Mats., is recorded from larvae of *Arctornis chrysorrhoea*, L. (*Porthesia similis*, Fuessly) in Hokkaido. Mature parasitised host larvae are about half the size of unparasitised ones.

KÔNO (H.) & INOUYE (M.). **Eine neue Art von Aphididen, schädlich an Sachalintannen.** [A new species of Aphid, injurious to *Abies sachalinensis*.]—*Insecta matsum.* **13** no. 1 pp. 41–43, 2 figs., 1 ref. Sapporo, 1938.

The winged viviparous female is described of *Cinara hattorii*, sp. n., found on the trunks and thick branches of *Abies sachalinensis* in Hokkaido.

KÔNO (H.). **Die Rhizophagiden im Tannen- und Fichtenwald in Japan.** [The Genus *Rhizophagus* in Fir and Spruce Forests in Japan.]—*Insecta matsum.* **13** no. 1 pp. 45-46. Sapporo, 1938.

Both adults and larvae of the Nitidulids of the genus *Rhizophagus* are known to be predacious on Scolytids. Of the species recorded in this paper, *R. japonicus*, Reitt., was found together with *Xyleborus todo*, Kôno, and *Polygraphus proximus*, Bldf., under the bark of *Abies sachalinensis* in Hokkaido, *R. simplex*, Reitt., in *Picea jezoensis* containing Scolytid tunnels in Sakhalin, and together with *Polygraphus gracilis*, Niisima, and *Trypodendron proximum*, Niisima, under the bark of *P. glehni* in Hokkaido, and *R. nobilis*, Lewis, in a tunnel of *Trypodendron* sp. in *P. jezoensis* in Sakhalin.

KAWANO (T.). **On the Oviposition Sites of *Calandra oryzae* L.** [*In Japanese.*]—*Insect World* **43** no. 2 pp. 41–43, 1 fig. Gifu, 1939.

Observations in Japan showed that females of *Calandra oryzae*, L., oviposit more commonly on the middle part of a grain of rice than near or at the ends.

OHTA (Y.). **List of Insect Pests of Gardening in Japan. I.** [*In Japanese.*]—*Insect World* **43** no. 2 pp. 43–46. Gifu, February 1939.

This list of insect pests in gardens in Japan includes the sawflies, *Acantholyda nipponica*, Yano & Sato, and *Cephaleia sachalinensis*, Mats., and an unidentified Cecidomyiid of the genus *Diplosis*, all of which attack pine.

TAKAHASHI (H.). **On the Spread of the Larvae of *Chilo infuscatellus* Snellen on the young Stage of Sugar-cane.** [*In Japanese.*]—*J. Formosan Sug. Plant. Ass.* **17** no. 2 pp. 49–58. Formosa, 1939.

Infestation of sugar-cane in Formosa by *Chilo infuscatellus*, Sn., is almost confined to young plants. In experiments, the larvae bored into the plants as soon as they hatched, but most of them subsequently migrated to fresh canes, mainly in the direction of the wind. The distance they covered was usually short, seldom more than two yards.

SONAN (J.). **Insects injurious to the Seeds of Tea Plants.** [*In Japanese.*] —*Formosan agric. Rev.* **35** no. 1 pp. 38–45, 2 figs. Taihoku, 1939.

In Formosa, the seeds of the tea plant are attacked by the larvae of the Trypetid, *Adrama apicalis*, Shiraki, the Anthomyiid, *Parahydrotaea jacobsoni*, Stein, the Tortricid, *Lobesia aeolopa*, Meyr., and a

weevil, but the injury caused is slight. The larvae of the weevil, which also attack the seeds of *Camellia oleifera*, occur singly in the fruits, mostly in June and July, disappearing in September. *P. jacobsoni* also infests damaged shoots of bamboo, and *L. aeolopa* occurs on the leaves of litchee.

SONAN (J.) & TADASA (Y.). **Influences of Whitewash on the Growth of Tea Bushes.** [*In Japanese.*]—*Formosan agric. Rev.* **35** no. 2 pp. 83–110. Taihoku, 1939.

In Formosa, the Tineid, *Casmara patrona*, Meyr., *Zeuzera coffeae*, Nietn., *Xyleborus fornicatus*, Eichh., and the Cerambycid, *Aeolesthes induta*, Newm., bore into the stems of tea, the last-named causing considerable injury in the mountainous districts of the centre and south of the island. Washing the stems with lime repels the ovipositing females, but in experiments, whitewash injured the plants if it contained salt, and often damaged young plants even if made without salt. Covering the lower parts of the stems with rice straw, the leaf-sheaths of palms or old rubber tyres effectually prevents oviposition.

KUWAYAMA (S.). **Report on the Distribution of and the Conditions of Injuries by Insect Pests of important agricultural Crops in Manchukou.** [*In Japanese.*]—*Sangyobu Shiryo* no. 33, 112 pp., 11 pls. Shinkyo, Manchuria, Bur. Ind. Govt Manchukou, 1938.

Records are given of 177 insects that attack various crops in Manchuria, together with notes based on the literature and the author's observations on the more important. These include *Pyrausta nubilalis*, Hb., on maize and sorghum ; *Chilo simplex*, Btlr., on rice, Italian millet [*Setaria italica*] and *Echinochloa crus-galli* ; *Sogata furcifera*, Horv., and *Delphacodes striatellus*, Fall., on rice ; *Empoasca* (*Chlorita*) *biguttula*, Mats., and *Platyedra* (*Pectinophora*) *gossypiella*, Saund., on cotton ; *Cydia* (*Grapholitha*) *glycinivorella*, Mats., *Tortrix* (*Pandemis*) *heparana*, Schiff., *Lycophotia praecox*, L., *Pyrrhia umbra*, Hfn., *Lachnosterna* (*Holotrichia*) *diomphalia*, Bates, *L.* (*H.*) *morosa*, Waterh., *Monolepta nigrobilineata*, Motsch., and *Luperodes quadriguttatus*, Motsch., on soy beans ; *Epilachna vigintioctomaculata*, Motsch., on potato ; *Eriosoma lanigerum*, Hsm., *Hyponomeuta padellus malinellus*, Zell., *Cydia* (*Grapholitha*) *molesta*, Busck, and *C.* (*G.*) *inopinata*, Heinr., on apple ; and *Lepidosaphes ulmi*, L., *Aspidiotus perniciosus*, Comst., *Illiberis pruni*, Dyar, and *Anthonomus pomorum*, L., on pear.

FENTON (F. A.). **The Insect Record for Oklahoma 1935–1936.**—*Proc. Okla. Acad. Sci.* **17** pp. 29–31. Norman, Okla., 1937. [Recd. 1939.]

Brief records are given of the insect pests prevalent in Oklahoma during 1935 and 1936, and a list is included of the 26 species of *Lachnosterna* (*Phyllophaga*) that have been taken in the state, several of which were caught in light-traps during the period under review. The larvae of three species of Arctiids, *Diacrisia* (*Isia*) *isabella*, S. & A., *D. virginica*, F., and *Estigmene acraea*, Dru., were unusually numerous in the spring of 1935. They caused severe injury to cotton seedlings, maize and melon crops, and also fed on ripening peaches, the fruits of tomato, and the flowers and pods of beans. *E. acraea*, which was

particularly abundant on white clover [*Trifolium repens*], comprised about 90 per cent. of the total population of these caterpillars, but was practically wiped out by disease.

Brunson (A. M.) & Painter (R. H.). **Differential Feeding of Grasshoppers on Corn and Sorghums.**—*J. Amer. Soc. Agron.* **30** no. 4 pp. 334–346, 4 figs., 11 refs. 1938. (Abstr. in *Exp. Sta. Rec.* **80** no. 1 p. 71. Washington, D.C., 1939.)

A report is given upon observations made in Kansas during the grasshopper outbreak of 1936, in which marked differences in the degree of injury to various types of maize were noted. Average defoliation of 5 randomised replications ranged from 4·0 to 59·8 per cent. for one series of 52 hybrids. In some instances, maize in one field was completely destroyed, while *Sorghum* in an adjacent field was practically uninjured. The varieties and inbred lines of maize that showed the greatest resistance usually originated in areas where grasshoppers are a natural element of the environment.

Cotton (R. T.). **Control of Insects attacking Grain in Farm Storage.**—*Fmrs' Bull. U.S. Dep. Agric.* no. 1811, 14 pp., 11 figs. Washington, D.C., 1938.

The first part of this bulletin comprises notes on the bionomics of *Sitotroga cerealella*, Ol., *Calandra* (*Sitophilus*) *oryzae*, L., *C.* (*S.*) *granaria*, L., and *Tenebroides mauritanicus*, L., which are the chief pests of stored grain in the United States, and brief references to *Tribolium confusum*, Duv., *T. castaneum*, Hbst., *Oryzaephilus surinamensis*, L., and *Laemophloeus minutus*, Ol., which are secondary pests so far as grain is concerned, as they do not attack it unless it is broken or damaged by other insects. The remainder deals with the precautions necessary to prevent infestation in the different regions of the country and with the fumigation of grain stored on the farm. Monthly inspections and immediate fumigation of infested grain are necessary during warm weather in the north and throughout the year in the south. The fumigants suggested for grain stored in bins are carbon bisulphide alone (which involves risk of fire) or mixtures of 1 part (by volume) carbon bisulphide and 4 parts carbon tetrachloride or of 3 parts ethylene dichloride and 1 part carbon tetrachloride. These fumigants, the properties of which are briefly discussed, are all applied by sprinkling them evenly over the surface of the grain, using 1–3 U.S. gals. carbon bisulphide or 3–5 U.S. gals. of either of the mixures per 1,000 bushels.

Folsom (J. W.) & Woke (P. A.). **The Field Cricket in Relation to the Cotton Plant in Louisiana.**—*Tech. Bull. U.S. Dep. Agric.* no. 642, 28 pp., 11 figs., 20 refs. Washington, D.C., 1939.

This paper contains accounts of experiments and observations made from 1930 to 1933 on the bionomics and control of *Gryllulus* (*Gryllus*) *assimilis* var. *pennsylvanicus*, Burm., attacking cotton in Louisiana. Much of the information has already been noticed [*R.A.E.*, A **19** 668; **22** 636], but more detailed results are given of work on egg production and incubation periods, together with tables showing the measurements and durations of development of the nymphal instars and descriptions of all stages.

GUI (H. L.). **Potato Flea Beetles and their Control.**—*Bull. Ohio agric. Exp. Sta.* no. 595, 29 pp., 3 figs., 6 refs. Wooster, Ohio, 1938.

An account is given of work, chiefly in 1930–34, on the bionomics and control of flea-beetles attacking potato in Ohio [*cf. R.A.E.*, A **20** 466; **22** 536], where the important species are *Epitrix cucumeris*, Harr., and *E. parvula*, F., though *Systena taeniata blanda*, Melsh., and *S. hudsonias*, Forst., occasionally cause damage. Life-history studies indicated that the two species of *Epitrix* have one complete generation a year and a partial second. The overwintered adults emerged from May to July, those of the first generation first appeared in mid-July, and those of the second in late August. Pyrethrum sprays reduced flea-beetle populations, but did not give commercial control. Calcium arsenate at the rate of 2 lb. in 50 U.S. gals. Bordeaux mixture containing 4 lb. copper sulphate and 6 lb. lime, applied at approximately weekly intervals during the growing period, was the most effective treatment, but supplementary tests in 1937 indicated that the amount of lime in the Bordeaux could be reduced to 3 lb. Applications of arsenicals with Bordeaux during either the first or the last half of the season, and the use of calcium arsenate and Bordeaux alternated with treatments with Bordeaux alone were unsatisfactory. When a schedule of dusts was employed, the addition of 1 lb. calcium arsenate to the usual dust of 2 lb. copper sulphate and 8 lb. lime was of value.

FRIEND (R. B.). **The Relation of Insects to the Conservation of Farm Woodlots.**—*J. For.* **36** no. 10 pp. 1004–1011, 37 refs. Washington, D.C., 1938.

This is a survey from the literature of the factors that affect infestation by various insects of the trees grown on farms in the United States to serve as shelter-belts, to prevent soil erosion, to provide logs, fuel or pulpwood, or for other purposes. These factors include the situation and nature of the site, the species of trees in the stand, their age, density and vigour, and the habits and abundance of the insect pests. In the case of cut timber, the time of cutting and the method of seasoning are important. The need is stressed for correct management of the stand based on consideration of these factors and supported where necessary by direct control measures.

HARRIS (K. H.). **Soil Conservation versus Insect Control.**—*Proc. ent. Soc. Wash.* **41** no. 1 pp. 20–26, 31 refs. Washington, D.C., 1939.

The author discusses, chiefly from the literature, the often conflicting cultural measures necessary for soil conservation and insect control and tabulates the contrasting features. The methods of insect control contributing to soil depletion include clean culture, burning over the land after harvest, and the elimination of grass and trees near growing crops.

QUAYLE (H. J.). **The Development of Resistance to Hydrocyanic Acid in certain Scale Insects.**—*Hilgardia* **11** no. 5 pp. 183–210, 3 figs., 19 refs. Berkeley, Calif., 1938.

The author reviews the literature on the resistance to hydrocyanic acid gas shown by certain local strains of *Aonidiella aurantii*, Mask., and *Saissetia oleae*, Bern., on *Citrus* in California [*cf. R.A.E.*, A **18**

41, 203; **22** 88, 99, etc.], to lead arsenate by Colorado strains of *Cydia pomonella*, L., on apple [*cf.* **22** 499, etc.], and to lime-sulphur by *Aspidiotus perniciosus*, Comst., in a particular apple district of Washington [**2** 378; **3** 758; **11** 417]. Resistance to fumigation with hydrocyanic acid gas in *Coccus pseudomagnoliarum*, Kuw., was first observed in California in 1925. Laboratory tests made by A. F. Swain in 1928-32 on resistant and non-resistant strains of this Coccid on orange twigs showed average differences in percentage mortality of 44·9 and 42·8, respectively. In August 1929, it was found that exposure to a concentration of 0·3 per cent. HCN for 90 minutes failed to kill all the resistant Coccids, whereas exposure to 0·05 per cent. for 60 minutes killed all of the non-resistant form. A concentration of 0·48 per cent. (more than 4 times as great as may ordinarily be used for *Citrus*) was necessary to effect a complete kill of the resistant form. Further tests made in 1937 indicated that this Coccid, which disappeared in 1934 and began to reappear in 1936, still retained its resistance.

In experiments, carried out by Swain in 1928 and 1931, by A. F. Kirkpatrick in 1936 and by the author, with resistant and non-resistant forms of *A. aurantii* from different *Citrus* groves, similar differences in mortality were observed. In current experiments with the two forms reared on banana squash under identical conditions in the laboratory, the difference in resistance has been maintained through four generations. Preliminary experiments indicated that they show a similar difference in their reactions to methyl bromide and ethylene oxide. It is considered that although there is some evidence of the spread of resistance from local centres, it must originally have developed in them independently.

Lindgren (D. L.). **The Stupefaction of Red Scale, *Aonidiella aurantii*, by Hydrocyanic Acid.**—*Hilgardia* **11** no. 5 pp. 213–225, 9 refs. Berkeley, Calif., 1938.

An account is given of laboratory investigations in California on the length of time for which stupefaction resulting from exposure to low concentrations of hydrocyanic acid gas [*cf. R.A.E.*, A **18** 41] affords protection to *Aonidiella aurantii*, Mask., against subsequent fumigation with the gas at normally lethal rates. The rates at which the HCN was introduced into the fumigation chamber are given as cc. per 100 cu. ft. Preliminary tests in 1935 showed that the average concentrations obtained during 40 minutes and the resulting mortalities were almost the same when the rate was 3 cc. and the gas was allowed to remain and when the rate was 12 cc. and the gas was gradually withdrawn to simulate the high-peak type of fumigation commonly applied to *Citrus* in tents [*cf.* **22** 99]. In 1936, Coccids of a resistant strain infesting 18–20 lemons from the same grove were exposed for 5 minutes to HCN at the rate of 0·5 cc. and either immediately or after intervals of 1, 2, 3 or 4 hours to 40 minutes' fumigation at the normally lethal rate of 3 cc., together with others on an equal number of lemons that had not been exposed to the low concentration. Natural mortality was estimated on untreated Coccids, and all were examined 10–14 days later. The average percentages of Coccids killed were 10·36 and 7·12 less in the stupefied than in the unstupefied individuals when fumigation took place immediately and 1 hour after stupefaction, and 2·33 and 4·81 greater (possibly on account of a

higher rate of respiration) when the intervals were 2 and 3 hours. When stupefaction had taken place 4 hours before fumigation, there was no significant difference in mortality. Similar results were given in 1937 by experiments in which the Coccids were exposed to the gas at the same low concentration and to subsequent fumigation at the rate of 12 cc., the gas being gradually withdrawn from the chamber.

When resistant laboratory-bred adults 40–42 days old were subjected to stupefaction and to fumigation at the rate of 4 cc., they reacted in the same way as those of the same strain collected in the field. Adults of a non-resistant strain bred in the laboratory reacted more slowly to the low concentration; thus, the mean percentage mortalities of those that had been subjected to the low concentration and exposed either immediately or 1, 2 and 3 hours later to fumigation at 2 cc. were 2·28, 24·08, 19·71 and 13·75 less than those of unstupefied individuals.

Tests with other insects showed that protective stupefaction was produced in *Calandra* (*Sitophilus*) *granaria*, L., but not in *Tribolium confusum*, Duv., and *Hippodamia convergens*, Guér.

Service and Regulatory Announcements, October-December 1938.—*S.R.A., B.E.P.Q.* no. 137 pp. 123–155. Washington, D.C., U.S. Dep. Agric., March 1939.

In Administrative Instructions (B.E.P.Q. 481) relating to Quarantine no. 13 against the Mediterranean fruit-fly [*Ceratitis capitata*, Wied.] and the melon fly [*Dacus cucurbitae*, Coq.], two alternative treatments are prescribed for application in Hawaii to fruit and vegetables that are to be shipped to the United States. They are cooling or heating the fruit or vegetable so as to maintain the temperature at the approximate centre at or below 35°F. for 15 days, or at 110°F. for 8 hours.

Other information in this part includes a revised summary of the plant quarantine restrictions of Switzerland, a summary of the plant quarantine restrictions of Tunisia, and amendments to restrictions issued by Argentina and Australia subsequent to summaries of these restrictions already published.

Australia. **Amendment of the Quarantine (Plants) Regulations.**—*Statutory Rules* 1939, no. 20, 1 p. Canberra, 1939.

The Quarantine (Plants) Regulations are amended by the addition of a sub-regulation providing that any person desiring to land cruciferous vegetables or lettuce in the Commonwealth of Australia shall furnish a certificate from a responsible officer of the Department of Agriculture of the country of origin identifying the vegetables, stating the quantity, and certifying that they were grown in the country named, that *Pieris rapae*, L., does not exist in the part of the country in which they were grown, that they were, on inspection prior to shipment, found to be free from *P. rapae*, and that they were packed in the country of origin in clean, new packages.

Annual Reports of the Sub-department of the Prickly-pear Land Commission for the Years 1936–7 & 1937–38.—*Rep. Land. Adm. Bd. Qd.* 1936–37 & 1937–38. Fol., 2 nos. Brisbane, 1937–38. [Recd. 1939.]

It is stated in the course of these Reports that successful control of the two most important species of prickly-pear (*Opuntia inermis* and

O. stricta) by *Cactoblastis cactorum*, Berg, assisted by the cochineal insect [*Dactylopius opuntiae*, Ckll.] is continuing in Queensland [*cf. R.A.E.*, A **25** 78, 298]. Regrowth and the germination of seeds have caused some re-infestation, which is severe in certain districts, but these areas provide valuable breeding grounds for *Cactoblastis*, which is present in sufficiently large numbers to ensure future control. The numbers of eggs of *Cactoblastis* distributed during 1936–37 and 1937–38 were 808,680 and 150,000, respectively. Infestations by *Dactylopius* have been heavy owing to dry autumns following the summer rains. The Argentine strain of *D. confusus*, Ckll., is quickly becoming established and is effectively reducing tiger pear (*O. aurantiaca*); it destroys both undergound and aerial parts of the plant. This Coccid, which thrives best in dry weather, is attacked by the indigenous Coccinellid, *Cryptolaemus montrouzieri*, Muls. The Lamiid, *Lagochirus funestus*, Thoms., and cochineal insects [strains of *D. opuntiae*] have proved promising for the control of the tree-pears, *O. tomentosa* and *O. streptacantha*, in central Queensland. During 1937–38, 42,000 eggs of the Lamiid were distributed; many failed to hatch owing to an early spell of hot dry weather, but the beetle is well established and further liberations are being made. Tree-pears that have been felled close to the ground and from which the branches have been lopped close to the stem are quickly destroyed by *D. opuntiae*. The total area of land reclaimed from prickly-pear since 1930 is 20,359,731 acres.

DAVIDSON (J.). **The Locust and Grasshopper Problem in South Australia.**—*J. Dep. Agric. S. Aust.* **42** no. 3 pp. 241–249, 6 figs., 8 refs. Adelaide, 1938.

Most of the information contained in this article has already been noticed [*cf. R.A.E.*, A **25** 348; **26** 583, 584, 629, 703]. The eggs of *Chortoicetes terminifera*, Wlk., do not develop in dry soil at temperatures below 60°F., but remain viable for several months. At temperatures slightly above 60°F. embryonal development takes several months; at 75°F. and at 98°F. it takes 30 and 11 days, respectively. The period required for development to the adult stage varies with the season; in mid-summer in South Australia it is 6–8 weeks.

ALLMAN (S. L.). **Breeding Experiments with Queensland Fruit Fly (*Strumeta tryoni* Frogg.).**—*J. Aust. Inst. agric. Sci.* **4** no. 4 pp. 204–205, 1 fig., 1 ref. Sydney, 1938.

Five females and one male of *Dacus* (*Strumeta*) *ferrugineus tryoni*, Frogg., that were bred from second-crop apples collected at Lindfield, New South Wales, and emerged on 19th September were placed in a wooden cage measuring 5×6×7 ins., with a sliding glass top and fine wire-gauze bottom, which was raised about $\frac{3}{4}$ in. by corner supports. Water and food, which consisted of sucrose and proteose protein (2 : 1) with the addition of water to moisten and a trace of yeast, were supplied by a method already noticed [*R.A.E.*, A **26** 561], and fruits were hung in the cage for oviposition. No oviposition took place on loquats, although they are readily infested in October in nature and the flies were seen on them, or on apples with rather tough skins, until, after 24 days, an apple was pricked in several places with a fine needle, when each puncture was immediately and repeatedly used for oviposition. When other varieties of apple were

used, some natural egg punctures were obtained, though many failures occurred. Although pairing was not observed, the larvae hatched in three days, and subsequently pupated. Flies of a second batch maintained in the same way, but without yeast, oviposited in seven days.

When punctured apples were exposed to the Mediterranean fruit-fly [*Ceratitis capitata*, Wied.], the females deposited eggs in the punctures, but were not attracted by them to the same extent as those of *Dacus*, and were apparently better able to pierce the skin.

WALLACE (C. R.). **Measurement of Beetle Borer Migration in Banana Plantations.**—*J. Aust. Inst. agric. Sci.* **4** no. 4 pp. 215–219, 2 figs., 2 refs. Sydney, 1938.

Investigations were carried out in New South Wales in 1934 and 1935 on the migration in banana plantations of adults of *Cosmopolites sordidus*, Germ., which have never been proved to fly in Australia. Of 64 marked weevils liberated in January 1934 on 16 stools, one of 21 recovered within 8 days had travelled at least 8½ ft., and another recovered 2 weeks later at least 70 ft. In March, 173 marked weevils were liberated on 14 stools, and on the following day two of these were recovered 8½ ft. away, and two others were 12½ and 20 ft. away. After a fortnight, two were found at distances of 36 and 38 ft., six were 18½–25 ft. from the nearest point of liberation, and only four were found in stools on which similarly marked weevils had been liberated. In April and May 1935, baits were placed in stools from 100 uninfested suckers planted in December 1933 in a ¼-acre plot separated from heavily infested plantations by a belt of *Paspalum dilatatum* 12–34 yds. wide. Only seven weevils were caught, whereas in one of the neighbouring plantations, baited in April, 113 were taken from 64 stools.

WALLACE (C. R.). **Effect of Cultivation on Susceptibility of Bananas to Beetle Borer.**—*J. Aust. Inst. agric. Sci.* **4** no. 4 pp. 220–225, 3 figs., 4 refs. Sydney, 1938.

To ascertain the effect of cultural methods on the infestation of bananas by *Cosmopolites sordidus*, Germ., in New South Wales, uninfested suckers were planted on 16th October 1934, one series of 8 in the usual manner, and another of 7 in small shallow holes on a thin layer of coarse soil and in contact with the sides of the holes. The soil round the first series was hoed on 18th October, 31st December and 31st January, so that the plants were growing in strips of tilled soil, whereas the weeds round the others were left untouched. Natural infestation by *C. sordidus* was permitted when the plants had become established. By 8th April, all the plants in the cultivated strips, which carried a light growth of weeds, had healthy leaves and well-developed pseudostems. The untreated strips of ground, however, were covered with a heavy growth of weeds, three of the plants were dead, three had some dead leaves, and one, round which the weeds were less dense, was healthy. When the suckers were examined, it was found that the rhizomes and bases of the pseudostems of those that had been neglected were very heavily attacked by the weevil, while in those that had been cultivated, they were almost free from injury.

Tjoa Tjien Mo. **Eenige aanteekeningen over de parasieten van *Setora nitens*.** [Some Notes on the Parasites of *S. nitens*.]—*Arch. Theecult.* **3** pp. 220–225, 7 refs. Buitenzorg, 1938.

The parasites obtained in April 1937 from larvae of *Setora nitens*, Wlk., collected on tea in Java comprised the Braconids, *Fornicia* sp., *Spinaria bicolor*, Szep., and *Meteorus* sp., the Ichneumonids, *Photoptera* sp. and *Goryphus javanicus*, Roman, and a Mermithid (which was rare). Those bred from pupae of the Limacodid were the Tachinid, *Chaetexorista javana*, Br. & Berg. [*cf. R.A.E.*, A **12** 293], and the Ichneumonids, *Chlorocryptus* sp. and *Cryptus oxymorus*, Tosq. The average percentages of the larvae parasitised by *Fornicia* and *Spinaria* were about 9 and 5·3, respectively. Of 39 larvae of *Fornicia*, 5 were themselves parasitised by *Ceraphron* (*Calliceras*) *manilae*, Ashm.

Guichard (F.). **Isolement de faibles quantités de roténone des graines oléagineuses.**—*Ann. Méd. Pharm. colon.* **36** no. 4 pp. 974–976. Paris, 1938.

All solvents of rotenone dissolve fats and oils to a certain extent, and if the source of the rotenone is oleaginous seeds, the evaporation of the solvents leaves an abundant oily residue containing it. If the rotenone is present in large quantities, it is relatively easy to isolate, but when the proportion is small, it is held in the oily material and its separation is difficult. The author describes a method used in the agricultural laboratory of Tonkin by means of which rotenone present in small quantities can be extracted from such oily material.

Alibert (H.). **Etude sur les insectes parasites du palmier à huile au Dahomey.**—*Rev. Bot. appl.* **18** no. 207 pp. 745–773, 17 figs., 15 refs. Paris, 1938.

Descriptions are given of the insect pests of oil palms (*Elaeis guineënsis*) in Dahomey, together with notes on the damage they cause and their distribution, bionomics and control.

The most important are the Dynastids, *Oryctes boas*, F., *O. monoceros*, Ol., and *O. agamemnon*, Burm., the adults of which bore from the bases of the petioles towards the terminal bud. Growth is retarded, young leaves are small or deformed, and if the attack is severe, the whole shoot may die. Females deposit 25–40 eggs in decomposing vegetable matter. The larvae hatch in 12–15 days, and pupate after a year, the pupal period lasting 19–27 days. The adults survive for up to 4 months. For control, waste matter on which eggs might be laid should be removed, felled or rotten trees should be buried more than 3 ft. deep and replaced by healthy ones, *Borassus* should be removed from the neighbourhood, and traps of vegetable débris and dung heaps near the plantations examined for larvae every 2–3 months. Night soil should be treated with an arsenical. Holes made in the palms should be plugged with a mixture of salt and sand (1 : 2). Adults can be killed by pushing a wire into the gallery or by pouring in turpentine, carbon bisulphide or a 2 per cent. solution of copper sulphate. The Carabid, *Neochryopus savagei*, Hope, is predacious on the adults and on all pests living in the crown of the plant.

Females of *Rhynchophorus phoenicis*, F., deposit over 500 eggs in the soft tissue of wounds, often in those caused by *Oryctes*. The larvae

tunnel towards the centre of the stem, but later return to the outer wood, and pupate in the crown in cocoons made of palm fibre, after 3–3½ months. The pupal stage lasts 20 days, and the adult weevils, which emerge from the cocoon after about a fortnight, feed on the sap from wounds, and live for about 2 months. The larvae may attack the crown, the trunk, or the roots of a young palm, and the decay that takes place in the tissues surrounding the tunnels may kill the tree. Wounding the trees should be avoided, and any wounds made washed with iron sulphate. The larvae can be killed with a wire, or by putting a pad soaked in carbon bisulphide into the gallery and then plugging it with clay mixed with coal-tar. The roots of young trees should be covered, and heavily infested trees burnt.

The adults of the Cetoniid, *Platygenia barbata*, Afzel. [*cf.* *R.A.E.*, A **21** 219], which live on the vegetable matter accumulated at the base of the leaves, are often numerous during dry months, but oviposit chiefly in the wet season (March–May). The egg, larval and pupal stages last 10–12 days, 5 months and 30 days, respectively. The larvae feed on the tender parts of the petioles, and sometimes on the bases of the inflorescences, but not on the terminal buds. The wounds in the petioles are attacked by other insects and by fungi, which cause decay of the heartwood. *P.* (*Clastocnemis*) *quadrimaculata*, Afzel., resembles *P. barbata* in life-history, but may attack the terminal buds of young plants, causing decay and the death of the trees.

Adults of *Temnoschoita quadripustulata*, F. (*quadrimaculata*, Gylh.) are attracted by the sap of the palm and oviposit in wounds in the crown, in the stumps left when the leaves are cut off, or in the stalks of the leaves or female inflorescences. The larvae burrow towards the centre of the crown, pupating in the tunnel formed, or may live in the bunches, between the fruits, into which they burrow. Young trees may be killed by attacks on the terminal bud. Bananas, which are also attacked, should not be cultivated near young plantations, wounding the trees should be avoided, and split leaf-stalks should be used as traps and burnt after a few days.

The Pyralid, *Pimelephila ghesquierei*, Tams, oviposits on the unopened leaves, chiefly of young trees. The larvae feed on the leaves, later forming small cavities in which they pupate. Several larvae may be found on one leaf, and continued attack may stunt and kill young trees. During severe infestations, arsenical sprays may be used against the larvae and light-traps against the adults. Young trees that have been attacked should be manured to encourage growth.

The weevils, *Prosoestus* (*Derelomus*) *plagiatus*, Fhs., *P.* (*D.*) *bilineatus*, Hust., *P.* (*D*). *kamerunicus*, Fst., *P.* (*D.*) *subvittatus*, Fst., *Prosoestus* sp. and *P. sculptilus*, F., which are common on male inflorescences [*cf.* **23** 293], occasionally also visit the female flowers, and may be of some assistance in pollination, though they are not indispensable. The eggs of the first four species are laid between the male flowers, and the larvae feed on the decomposing tissues of the flowers. The egg, larval and pupal stages last 4, 14 and 6 days, respectively. The adults of the other species feed on the fleshy stigmas of the female flowers, and lay their eggs in the hollows made in them. The larva of the unidentified species bores in the style, but causes only superficial damage. That of *P. sculptilus*, however, penetrates to the ovary and destroys the fruit completely. The egg, larval and pupal stages last 3, 10–12 and 2 days, and 4, 23–24 and 3–4 days, respectively. A number of pupae that failed to mature were found to be infested with Nematodes.

A Galleriine Pyralid that was found for the first time in 1937 and is briefly described under the name of *Eloeidiphilos aliberti*, Praviel, lays its eggs between the flower spikes, usually on unopened flowers. The eggs hatch in 6–8 days. The larva constructs a shelter by joining flowers together with threads. If it is on a male inflorescence it eats the flowers, if on a female, the fleshy stigmas. The pupal stage lasts 10–12 days. The adults do not live long, and females usually oviposit on the palm on which they have developed. In the dry season, the more fleshy female flowers are preferred. Infested inflorescences should be destroyed or sprayed with an arsenical.

Various Coccids sometimes completely cover the leaves and fruit or the fruit bunches, and are most likely to cause damage on trees that are not well spaced. A considerable degree of control is afforded by larvae of the predacious Coccinellids, *Chilochorus* sp. and *C. schioedtei*, Muls.

The stored oil-palm kernels are attacked by the Cucujids, *Ahasverus* (*Cathartus*) *advena*, Waltl, *Cathartus* sp., *Oryzaephilus* (*Silvanus*) *surinamensis*, L., *Silvanus fasciatus*, Reiche, and *Laemophloeus* sp., Nitidulids of the genus *Carpophilus*, and the Tenebrionid, *Palorus depressus*, F. Severe infestation may be controlled by fumigating with carbon bisulphide or chloropicrin.

Deleuze (J.) & Dussy (J.). **Influence de la cyanamide de chaux sur le doryphore.**—*C. R. Acad. Agric. Fr.* **25** no. 4 pp. 151–155, 1 ref. Paris, 1939.

Field experiments on the use of oiled calcium cyanamide powder against *Leptinotarsa decemlineata*, Say [*cf. R.A.E.*, A **27** 158] were continued in various regions of France in 1938. In a heavily infested field planted with wheat, oats and potatoes, the numbers of adults emerging from hibernation were about 45 per cent. less in plots on which the cyanamide was scattered at rates of 180 or 270 lb. per acre on 30th May, when emergence began, than in similar plots on which the applications were made on the date appropriate for each crop (21st November, 19th March and 5th May for winter wheat, spring cereals and potatoes, respectively). The results were unaffected by the rate of application. On potatoes that received a surface dressing at the rate of 180 or 270 lb. per acre on 30th May, followed by one at 90 lb. per acre on 10th June, the infestation was checked temporarily after each treatment, and remained permanently lower than that on untreated plots. When surface dressings (180 lb. per acre) were applied to potatoes a few days before or after adult emergence, larvae appeared 10 days later on them than on untreated potatoes ; but control of larvae and adults on the latter was obtained without injury to the plants by treatment at the rate of 90 lb. per acre on 29th June, 12 days after the appearance of the larvae, followed by a single application of a dust insecticide on 16th July. After July, the plants became more susceptible to injury by the cyanamide, but applications at the rate of 180 lb. per acre to four varieties of potato 1–4 weeks before harvest destroyed most of the beetles present and assisted lifting by drying up the vines, without affecting the quality or quantity of the crop.

Laboratory tests indicated that the toxic effect of cyanamide incorporated into the soil is of short duration, and that there is no definite relation between it and the rate of application, though high rates (over 1,000 lb. per acre) are more effective than low ones.

Feytaud (J.). **France : The Colorado Beetle** (*Leptinotarsa decemlineata*) **in 1938.**—*Int. Rev. Agric.* **29** no. 11 p. 244 M. Rome, 1938.

In 1938, the development of *Leptinotarsa decemlineata*, Say, on potato in France was retarded by the dry spring, but large swarms were seen in hot weather during June and at the beginning of August. The infestation spread towards the English Channel and the North Sea, and in Alsace and the Alpine valleys, and was intensified along the north-eastern and eastern frontiers. It was also found to be spreading in the Vosges, where it had been checked in 1935, and was observed within the borders of Var.

Wahlen (F. T.). **Switzerland : The Colorado Beetle Situation in 1938.**—*Int. Rev. Agric.* **29** no. 12 pp. 267 M–269 M. Rome, 1938.

Reports of the infestation of potato by *Leptinotarsa decemlineata*, Say, in Switzerland in 1938 [*cf. R.A.E.*, A **26** 70] showed that by 11th June small numbers of adults and egg-masses had been observed in the cantons of Geneva, Vaud, Neuchâtel, Bern, Solothurn, Basel, Aargau and Lucerne, and a few adults had been taken in vegetables imported from France. By 20th June, further foci had been discovered and controlled and the beetle had been reported in Fribourg. Larvae were rare until 30th June, but after that date they were found more and more frequently in French Switzerland, and after 10th July were fairly numerous and were beginning to pupate at the lower altitudes. Larvae were first seen in German Switzerland on 29th June, and the infestation had spread into Zürich by 12th July and into Zug and Thurgau by 26th July. The number of foci reported began to decrease in August, but pupae were found in most of them, and the infestation had spread to the canton of Valais. As all stages found were destroyed immediately, relatively few adults emerged, and very few second-generation eggs were discovered.

Ogijewicz (B.). **Krytyczny przegląd szkodników zaobserwowanych w północno-wschodniej Polsce w latach 1928–1937 ze szczególnym uwzględnieniem ich znaczenia gospodarczego.** [A critical Survey of Pests observed in north-eastern Poland in the Years 1928–37 with special Reference to their economic Importance.]—*Roczn. Ochr. Rośl.* **5** fasc. 6 pp. 1–52. Puławy, 1938. (With a Summary in German.)

In this paper, lists are given of 268 pests (chiefly insects) that were observed in the Provinces of Wilno and Nowogródek in 1928–37 in orchards and forests, on field crops, vegetables, ornamental plants, and flax, and in stored grain and flour. The pests are arranged under their orders in tables showing their food-plants and frequency, and the localities and years in which they appeared in large numbers.

Jeż (S.). **Płaszczyniec burakowy** (*Piesma quadrata* **Fieb.**) **w świetle badań przeprowadzonych na terenie woj. Poznańskiego w roku 1936/37.** [The Beet Bug (*P. quadratum*) in the Light of Observations in the Province of Poznań in the Year 1936–37.]—*Roczn. Ochr. Rośl.* **5** fasc. 5 pp. 1–25, 1 map, 6 graphs, 8 figs. Puławy, 1938. (With a Summary in German).

In Poland, *Piesma quadratum*, Fieb., is steadily spreading to the north and east, at the estimated rate of about 20 miles a year.

Investigations on its bionomics in the province of Poznań [*cf. R.A.E.*, A **24** 676 ; **27** 163] in 1936 and 1937, when it was very abundant, showed that the dates on which the overwintered adults leave their hibernation quarters depend on temperature and humidity. In 1936 they continued to appear at intervals from 15th April to 22nd May, but in 1937 they all appeared during the first half of May. Migrations are effected by crawling or, when the temperature is above 16°C. [60·8°F.], by flight ; on windy days, flying bugs are carried by the wind and may thus be prevented from alighting in beet fields. A period of 3–7 days elapsed between pairing and oviposition in the laboratory, and the first eggs were observed in the field on 5th May in 1936 and on 10th May in 1937. The eggs hatch in 2–3 weeks, and the life-cycle from egg to adult is completed in 33–86 days, varying with the weather. Nymphs from eggs laid on the soil or on withered plants migrate in search of food, which they find by chance, since it was observed that young nymphs that had not fed passed as close as 3 mm. to beet without being attracted to it. Usually, such migrating nymphs do not survive without food more than 2 days. As the overwintered females continue to oviposit till the end of August and some of those of the first generation also lay eggs, all stages of the bug are present throughout the vegetative period of the beet. Nymphs that hatch too late to complete their development do not survive the winter. The adults of the first generation appeared in the second half of June in 1937, and some began to enter hibernation at the beginning of July. Mass-flight, however, occurred in July, and observations showed that migrations were induced by high temperature and not by lack of food. The adults are resistant to cold. Hibernating individuals found covered with hoar frost on telegraph posts at −9°C. [15·8°F.] revived in a minute when warmed, and bugs kept at −3°C. [26·6°F.] and transferred to a temperature of −14°C. [6·8°F.] for two hours almost all survived. Heavy rains do not affect the adults, but they wash the nymphs from the leaves and beat them into the soil ; they sometimes also kill the eggs. The bugs were most numerous on beet on light soil, and heavy, clay soils were avoided. Neglected fields covered with weeds were most heavily infested. When adults were placed on over 20 different plants, chiefly vegetables, they remained on beets, mangels and spinach, but had abandoned all the others in two days ; one pair remained on *Atriplex* and gave rise to progeny. Individuals that were induced to feed on beans all died in a few days.

The different types of leaf-crinkle transmitted by *P. quadratum* to beet, mangels and spinach are described, and the use of trap strips of beet to control the bugs is discussed. These strips should be sown, not later than 10th April, 3–10 ft. from the edges of fields destined for beet ; the ends of the strips should not meet. In beet fields over 10 acres in area, a trap strip should be sown along each side, but in smaller fields one on the longest side is sufficient. If the nature of the soil in the fields does not permit the deep ploughing that is required for trap strips, trap plots should be sown in fields that were under beet in the preceding season, and in any others close to the hibernation quarters of the bug. In fields of up to 5, 10 and over 10 acres, the trap plots should cover 10, 8 and 5 per cent. of the surface, respectively. In both strips and plots, the beet should be sown as densely as cereals, and, when the overwintered bugs have congregated on them, they should be ploughed in before the beet in the fields has sprouted. Fields for seed-beet should also be protected by trap strips and should be

planted only after the beet in the strips has sprouted. Winter spinach and the early spring varieties should be gathered before, and summer spinach and mangels sown after, the trap strips are ploughed in. Effective control of the bug by trap strips is dependent on co-operative application of the method over large areas.

Other Piesmids found in Poland were *P. maculatum*, Lap., its variety *viride*, Jak., and the brachypterous and macropterous forms of *P. capitatum*, Wolff, all of which occurred on *Atriplex* and infested beet rarely and only for a short time, before *Atriplex* sprouted. They were successfully reared on beet in the insectary, but did not transmit the virus of leaf-crinkle from diseased to healthy plants [*cf.* **27** 163]. Characters distinguishing these Piesmids from *P. quadratum* and its variety *dilatatum*, Jak., are briefly described.

Sprawozdania z konferencyj w sprawie występowania płaszczyńca burakowego odbytych w latach 1934–1938. [Reports presented at Conferences on the Question of the Occurrence of the Beet Bug in the Years 1934–38.]—*Roczn. Ochr. Rośl.* **5** fasc. 5 pp. 50–85, 3 refs. Puławy, 1938.

Summaries are given of discussions that took place during a series of conferences on the status and control in Poland of the beet bug [*Piesma quadratum*, Fieb.] held in November and December 1934, April and November 1935, February and November 1936, and February, March and November 1937. The chief points dealt with have already been noticed [*cf. R.A.E.*, A **24** 676; **27** 105, 163, 350]. Appendices contain instructions on the application of trap strips and plots of beet for the control of the bug, and the texts of regulations issued in March 1938 empowering local authorities to enforce their use.

Hadersold (O.). **Ergebnisse von Parasiten-Zuchten der Zweigstelle Stade der Biologischen Reichsanstalt für Land- und Forstwirtschaft.** [The Results of Rearing Parasites at the Stade Branch of the Imperial Biological Institute for Agriculture and Forestry.]—*Arb. physiol. angew. Ent. Berl.* **6** no. 1 pp. 1–14, 3 figs. 12 refs. Berlin, 1939.

Records are given of 17 Chalcidoids, 2 Cynipids, and 2 Scelionids bred since 1926 from insects attacking fruit and other trees and plants at Stade, together with a table, arranged by hosts, showing the Hymenopterous parasites recorded in this and the two preceding parts [*R.A.E.*, A **26** 420; **27** 113].

Tischler (W.). **Schaden und Bekämpfung der getreideschädlichen Blattwanzen.** [The Injury caused by and Control of Leaf Bugs harmful to Cereals.]—*Arb. physiol. angew. Ent. Berl.* **6** no. 1 pp. 14–32, 3 figs., 36 refs. Berlin, 1939.

In connection with work on the infestation of cereals in Germany by Pentatomid bugs [*cf. R.A.E.*, A **26** 51; **27** 63], investigations are described on the types of injury caused by them to wheat and rye. The technique adopted was to enclose adults of *Eurygaster*, *Aelia* and *Dolycoris* with the plants in field cages. The injury caused by the bugs feeding on the green plants was negligible compared with that

caused to the ripening grains. These may be shrivelled, or dented, or may show puncture spots without other local injury [*cf.* **25** 309]. Deterioration of the gluten [*cf.* **24** 485], reduction in weight, and, sometimes, decrease of germinating power result from the attack. In 562 samples of wheat of the 1937 crop from all parts of Germany, the percentage of grains injured by puncturing averaged 1·4; the percentages were higher (averaging up to 5·5) in samples from eastern Germany than in those from the north-west. Comparisons with crops of previous years indicate some decrease in infestation.

Methods of control are discussed in detail from the literature. In Germany, the most favourable period for controlling the bugs is immediately after the harvest while they are still in the stubble. In laboratory and field experiments, no mortality was given by spraying with petroleum in soap solution or dusting with derris, but adults of all species were killed by dusting with a preparation of dinitro-cresol at the rate of 29 lb. per acre; individuals sheltering under leaves and those arriving later were unaffected. An investigation in which a strip of *Verbascum thapsiforme* was sown along the edge of a rye field showed that *Carpocoris* and *Dolycoris* preferred this food-plant in May, but migrated to the rye for oviposition. At the end of July, when the rye was cut, they returned to *Verbascum*. The cultivation of varieties rich in gluten, and the treatment of flour with lactic acid, which compensate to a great extent for the loss in gluten quality due to the attack, are suggested.

BARNES (H. F.). **A new Gall-midge attacking Beech Buds.**—*Arb. physiol. angew. Ent. Berl.* **6** no. 1 pp. 41–43, 1 fig. Berlin, 1939.

FISCHER (H.). **Zur Biologie und Bekämpfung von Knospen-Gallmücken an Rotbuchen.** [The Biology and Control of Bud Gall-midges on Beech.]—*T.c.* pp. 44–51, 3 figs.

In the first paper, descriptions are given of the larva and adults of both sexes of *Dasyneura fagicola*, sp. n.; the larvae were taken in buds of beech in Schleswig-Holstein in association with those of *Contarinia fagi*, Rübs.

In the second paper are recorded observations on these gall-midges and their control. It is not known whether *D. fagicola* is a primary pest or merely an inquiline in buds attacked by *C. fagi*. The buds are withered or deformed from June onwards. The adults of both Cecidomyiids appear about the end of May or early in June, and the females deposit 4–6 eggs in the bud, between the leaflets.

The larvae suck the leaflets in the bud and after 3–4 weeks pupate in the ground. The pupal stage lasts 4–6 days in summer. There are 3–4 generations a year, the pupae hibernating in the ground. The larvae from adults present in July appear to cause the greatest injury. If the bud is in an early stage of development, it withers soon after the larvae have left it; if it is well developed, the outermost leaflet remains, but is deformed.

Various control measures were investigated in 1938. The treatment recommended is an application of tobacco dust in the last week in May, followed by two applications of a spray of 0·1 per cent. nicotine in the first week of June. Additional applications of the spray should be made between 5th and 10th July and 10th and 20th August. It also controls *Phyllaphis fagi*, L. New plantations of beech should be situated as far as possible from infested trees.

TEMPEL (W.). **Ein Massenauftreten von Asopinen (Hemiptera: Pentatomidae).** [A Mass Occurrence of ASOPINAE.]—*Arb. physiol. angew. Ent. Berl.* **6** no. 1 pp. 51–56, 5 figs., 3 refs. Berlin, 1939.

In a forest district in Hessen in which beech, oak and pine were being defoliated by *Lymantria* (*Porthesia*) *dispar*, L., in July 1938, Pentatomid nymphs, chiefly those of *Pinthaeus sanguinipes*, F., were observed, up to 30–40 being collected on some trunks below adhesive bands. They were predacious on larvae of *L. dispar*, *Aglia tau*, L., *Dasychira pudibunda*, L., Noctuids, and young larvae of *Calosoma*. Adults of the predacious Carabids, *Calosoma sycophanta*, L., and *C. inquisitor*, L., were also present in small numbers. In the laboratory, nymphs of *P. sanguinipes* readily attacked the larvae already mentioned and also those of *Leptinotarsa decemlineata*, Say, *Vanessa io*, L., Geometrids and sawflies, and their own species. The method of attack is described. Adults of *Troilus luridus*, F., which were also found in the forest, fed on all the insects offered, especially on larvae of *L. dispar*, *D. pudibunda*, *V. io*, *V. urticae*, L., *Pieris brassicae*, L., *Diacrisia* (*Spilosoma*) *lubricipeda*, L., Noctuids, Geometrids, sawflies, and *L. decemlineata*, and also on pupae of *V. io*. The distribution in Germany of *P. sanguinipes* and *T. luridus* is given, and it is considered that Pentatomids of the subfamily ASOPINAE can be of considerable value in reducing insect outbreaks.

HASE (A.). **Ueber die Lebenszähigkeit von** *Anthrenus verbasci* **L.** [On the Vital Tenacity of *A. verbasci*.]—*Arb. physiol. angew. Ent. Berl.* **6** no. 1 pp. 56–62, 1 fig., 7 refs. Berlin, 1939.

The contents of a sealed glass container, opened 3 years after 40 larvae of *Anthrenus verbasci*, L., and a dried deer's foot had been placed in it, included one living larva, 5 recently dead ones, larval and pupal exuviae, chitinous remains of adults and excreta. Feeding had reduced the weight of the deer's foot from 40 to 38·5 grams. The causes of the death of the colony and the number of generations that may have developed are discussed.

THALENHORST (W.). **Ergebnisse einer Zucht von** *Meteorus versicolor* **Wesm. (Hymenoptera: Braconidae).** [The Results of Breeding of *M. versicolor*.]—*Arb. physiol. angew. Ent. Berl.* **6** no. 1 pp. 73–75, 4 refs. Berlin, 1939.

In the course of investigations in connection with an outbreak of *Panolis flammea*, Schiff., on pine in the region of Merseburg in 1938, it was observed that a considerable number of larvae of this Noctuid were parasitised by *Meteorus versicolor*, Wesm. Cocoons of the Braconid were found in August in breeding cages on pine twigs used as food for the larvae of *P. flammea*, and gave rise to adults in 8–10 days. Males were rare. The females, which survived for up to about 2 months, oviposited in larvae of the Lasiocampid, *Dendrolimus pini*, L., offered to them in August, and cocoons were found on 28th and 30th November, from which adults emerged on 8th and 12th December. *M. versicolor* seems therefore to produce, at least in some parts of Germany, two generations a year in different hosts.

Zacher (F.). **Der Samenzünsler jetzt auch in Berlin.** [*Aphomia gularis* now also in Berlin.]—*Mitt. Ges. Vorratsschutz* **15** no. 2 pp. 20–21, 1 fig. Berlin, 1939.

The Asiatic Pyralid, *Aphomia* (*Paralispa*) *gularis*, Zell., which has been recorded in Hamburg and the Rhineland during the last few years [*R.A.E.*, A **21** 176 ; **22** 559 ; **25** 268] was found in 1938 infesting rye in a warehouse in Berlin. This is the first record of the moth from cereals in Germany. The adults and larvae are briefly described, and a list is given of the stored products on which the larvae feed.

Lindblom (A.). **Skadedjur i Sverige år 1936.** [Pests in Sweden in 1936.]—*Medd. Växtskyddsanst.* no. 26, 71 pp., 25 figs., many refs. Stockholm, 1938.

Lists are given of agricultural and horticultural pests reported by various observers in Sweden in 1936, with notes on their distribution and frequency. In all, 281 species were reported, including 247 insects and 17 mites. In some cases, methods of control are outlined.

Marcu (O.). **Beiträge zur Kenntnis der Oekologie und Verbreitung einiger Kieferschädlinge** (*Brachonyx pineti* **Payk. und** *Anthonomus varians* **Payk.) in Rumänien.** [Contributions to the Knowledge of the Ecology and Distribution of certain Pests of Pine (*B. pineti* and *A. varians*) in Rumania.]—*Bul. Fac. Şti.* **8** fasc. 1–2 pp. 179–183, 2 refs. Cernăuţi, 1935. (With a Summary in Rumanian.) [Recd. 1939.]

Observations in Rumania since 1928 have shown that *Brachonyx pineti*, Payk., and its variety, *obscurella*, Pic, are widely distributed on pine (*Pinus sylvestris* var. *hamata*). This weevil has one generation a year. Females oviposit in cavities on the inner sides of the needles from mid-May, and the larvae tunnel towards the base of the needles, and pupate in their galleries. The adults emerge at the end of July or the beginning of August, feed on the epidermis of the needles, and seek hibernation quarters under ground-litter in October. Young pines are seriously injured by the larvae, the needles become discoloured, and if severe attack continues for several years, the trees die. The only method of control available is the collection of infested needles in June and early July, before the emergence of the adults.

Slight injury is caused to old pines (*P. sylvestris* var. *turfosa*) by *Anthonomus varians*, Payk., females of which oviposit in the male inflorescences. The larvae feed on the pollen. The adults emerge in mid-July and feed on the needles.

The Importation of Plants Order of 1939.—*S.R.O.* 1939 no. 532, 12 pp. London, 16th May 1939.

This Order, which came into force on 1st June 1939, amends and consolidates existing regulations affecting the importation of plants, etc., into England and Wales [*R.A.E.*, A **21** 426 ; **24** 338 ; **25** 404]. All consignments of living plants and parts thereof (except seeds) for planting and all potatoes must have been officially examined, not more than 14 days before shipment, by the authorities of the country in which they were grown, and certified to have been found healthy and

free from any insect destructive to agricultural or horticultural crops. Consignments not consisting wholly of potatoes must be certified to contain no plant of sugar-beet, mangel or chrysanthemum or any plant of the genera *Ulmus, Abies, Larix, Picea, Pinus, Pseudotsuga, Sequoia, Thuja* and *Tsuga*, except the seeds thereof. The importation of any plant of sugar-beet or mangel of the species *Beta vulgaris* or any chrysanthemum plant except the seeds thereof is prohibited except under licence, this regulation being designed to prevent the introduction of virus diseases of beet and of the chrysanthemum fly, *Diarthronomyia hypogaea*, Lw. The importation and, except under licence, the transhipment in ports of potatoes (including leaves and stalks) grown in the United States, Canada or European France is prohibited, and potatoes from other countries must have a certificate that no case of wart disease has occurred at any time on the holding where they were grown, or within 2 km. thereof. Consignments of living plants or parts thereof for planting (not including flower bulbs, corms, tubers or rhizomes) grown in France, Belgium, Luxemburg, Germany, Switzerland and the Netherlands and potatoes grown in the last five countries must be accompanied by an additional certificate stating that during the twelve months preceding its issue there has been no outbreak of the Colorado beetle [*Leptinotarsa decemlineata*, Say] in the country of origin within 50 km. of the place where the plants, etc., were grown.

Raw vegetables, excluding mushrooms and cucumbers, imported from European France or Switzerland between 21st April and 30th September, must be accompanied by the Colorado beetle certificate (vegetables from the French departments of Nord and Pas-de-Calais being exempt between 21st April and 21st May, provided that a certificate of departmental origin is produced), those imported from Belgium, Luxemburg, Germany and the Netherlands between 1st June and 30th September must be accompanied by the Colorado beetle certificate and those imported from any other country between 21st April and 30th September by a certificate of origin. Cider apples imported from European France or Switzerland between 21st April and 30th September must be accompanied by the Colorado beetle certificate, those imported from Belgium, Germany, Luxemburg and the Netherlands between 21st April and 31st May by a certificate of origin and between the 1st June and 30th September by the Colorado beetle certificate, and those imported from any other European country between 21st April and 30th September by a certificate of origin. Provision is made by a General Licence for the entry between certain dates of various plants and raw vegetables from European countries to which the Colorado beetle restrictions have been applied with a certificate alternative to the Colorado beetle certificate.

Raw apples imported from the United States between 7th July and 15th November must be certified to be of one or other of the two highest grades recognised by the Federal Department of Agriculture.

Fumigation with Hydrocyanic Acid Gas.—*Adv. Leafl. Minist. Agric.* no. 92, 4 pp. London, H.M.S.O., 1934; revised 1938. Price 1*d.*; 9*d.* per dozen.

The chief pests in Great Britain against which hydrocyanic acid gas is usually employed for greenhouse fumigation are *Trialeurodes vaporariorum*, Westw., mealybugs and other Coccids; it is also effective

against thrips and Aphids, which are, however, more often controlled by a nicotine spray or fumigant. Dosages and methods are given for fumigation against these insects with calcium cyanide and with sodium cyanide and sulphuric acid.

Balachowsky (A.). **Sur les dégats de l'Apion méridional de l'artichaut** *Apion* (*Ceratapion*) *carduorum* **Kirby var.** *galactitis* **Wenck.**—*Rev. Path. vég.* **25** fasc. 4 pp. 229–233, 1 fig., 4 refs. Paris, 1938.

In certain seasons, *Apion carduorum*, Kirby, var. *galactitis*, Wenck., causes serious damage to artichokes in the south of France. It was particularly abundant in 1936 and 1938. Characters are given by which it may be distinguished from the typical *A. carduorum*, which is much less injurious to artichokes [*cf. R.A.E.*, A **13** 95]. Unlike the latter, it is restricted to the Mediterranean region. The females oviposit in the flower stems in late February or March. The larvae begin to tunnel in the stems in March, and damage is at its height in the middle of the month. The tunnels are irregular and filled with frass, and each contains several larvae. The stems either break or are so weakened that the flower-heads wither. Tunnels sometimes extend to the capitulum. Adults emerge in April, but do not oviposit in late artichokes. If there is a second generation, as appears probable, it develops on *Galactites tomentosa*, the normal food-plant of the weevil. Infested stalks should be burnt before the emergence of adults begins.

Mattras (H.). **Trois années d'observation sur le carpocapse** (*Laspeyresia pomonella* **L.**) **dans les vergers du sud-est de la France.**—*Rev. Path. vég.* **25** fasc. 4 pp. 234–238, 5 refs. Paris, 1938.

Observations are recorded on the dates of emergence of adults of *Cydia* (*Laspeyresia*) *pomonella*, L., in apple or pear orchards in different parts of south-eastern France in 1936–38. A statistical comparison of temperatures at dusk and the number of adults caught per 100 observations during 1937 showed that about twice as many moths were in flight at evening temperatures between 19 and 24°C. [66·2 and 75·2°F.] as at lower or higher temperatures.

Fintzescu (G.). **Les trois psylles du poirier.**—*Rev. Path. vég.* **25** fasc. 4 pp. 244–254, 3 figs., 1 ref. Paris, 1938.

The three species of *Psylla* taken on pear by the author were *P. pyrisuga*, Först., *P. pyri*, L., and *P. pyricola*, Först. All have three or sometimes four generations a year in north-eastern Rumania. Notes are given on the appearance of the various stages and the time of year at which they were observed.

Trouvelot (B.), Muller-Böhme (—) & Lacotte (—). **Remarques sur le comportement du doryphore** *Leptinotarsa decemlineata* **Say, sur des hybrides** *Solanum demissum—Solanum tuberosum* **(première note).**—*Rev. Path. vég.* **25** fasc. 4 pp. 273–276. Paris, 1938.

Experiments were begun in 1936 on the larval development of *Leptinotarsa decemlineata*, Say, on primary hybrids of *Solanum tuberosum* (potato) and *S. demissum* and on recrosses of these with *S.*

tuberosum [*cf. R.A.E.*, A **24** 190 ; **27** 107]. The latter were intermediate between the two parents in their suitability for development of the larvae. Mortality and the length of the larval stage were greater, and the amounts consumed by the larvae each day and throughout life were less, on plants that were more like the primary cross. Mortality on leaves in the laboratory did not exceed 50 per cent., but on shoots of a primary cross was 50–100 per cent. In the open, only 1–3 larvae out of 20 developed on this food-plant, whereas 8–12 developed on non-resistant plants. Mortality was greatest among the young larvae. Plants unsuitable for the larvae could be distinguished by the numerous small holes made in the leaves. The pupal stage of individuals reared on resistant hybrids was of normal duration, but the resultant adults were small. After feeding on the same plants, they entered hibernation, but only in small numbers and abnormally late. When the temperature fell in autumn, development ceased on plants of the resistant type, although their leaves were still green and development was continuing on *S. tuberosum*. The resistant hybrids are a little more tuberiferous than *S. demissum*, but less so than *S. tuberosum*.

VAYSSIÈRE (P.). **La désinfection des châtaignes.**—*Rev. Path. vég.* **25** fasc. 4 pp. 277–293, 1 fig., 14 refs. Paris, 1938.

Curculio (*Balaninus*) *elephas*, Gylh., and *Cydia* (*Laspeyresia*) *splendana*, Hb., are serious pests of chestnuts in France, where both have one generation a year and also infest acorns. The adults are present from the middle of July till October. The eggs of *Curculio* are deposited singly in little holes made in the fruit, and those of *Cydia* at the base of the ovaries before the fruit is formed. The larvae enter the cotyledons, and their entrance holes rapidly become invisible. The presence of a larva of *Curculio* in a chestnut is very difficult to detect, but infestation by *Cydia* is revealed by a sinking of the base and the formation of ridges from the base to the tip. The larvae leave the chestnuts about 40 days after oviposition, enter the soil, where they pass the winter, and pupate about mid-June. Infested fruits usually fall prematurely, and are often attacked by fungi of the genera *Mucor*, *Rhizopus*, *Aspergillus*, etc. In Italy, more than half the crop is sometimes infested, and about 85 per cent. of the injury is caused by *Cydia*, but in France, the difference in importance between the two species is much less.

Infestation can be considerably reduced by cultural methods, such as regular pruning, freeing the ground from weeds, daily collection of all fallen fruits before the larvae have time to leave them, sorting them on a cement floor or, failing that, on one of beaten earth, and immediate destruction or use on the farm of all waste, unsaleable or infested chestnuts. Fumigation of the soil under the trees with carbon bisulphide in late spring to kill the pupae has been recommended ; the author suggests that the application of quick lime or calcium cyanamide at the rate of about 450 lb. per acre might be of value. As chestnuts are grown in France largely for export to the United States, and the regulations of that country require that no consignment shall contain a living insect [*cf. R.A.E.*, A **16** 563 ; **17** 709], the disinfestation of chestnuts after harvest is of the greatest importance. Fumigation for 1½ hours with carbon bisulphide (1 : 100 by weight) was first recommended, but, apart from the risk of fire, this impairs

the quality of the chestnuts. Soaking for 45 minutes in water maintained at 50°C [122°F.] and drying in thin layers until the normal humidity is restored gives satisfactory control, but affects the keeping qualities of the chestnuts and appears to favour the development of fungi, particularly *Sclerotinia pseudo-tuberosa*. To prevent this, a suitable disinfectant should be added to the water. Fumigation with ethylene oxide at atmospheric pressure is not effective. In tests during November and December 1936, in which chestnuts were subjected for 3 hours at 10·5–12°C. [50·9–53·6°F.] to fumigation with 3–6 oz. ethylene oxide and 15 oz. carbon dioxide per 50 cu. ft. introduced at a vacuum of 700 mm., which was then reduced to 30–50 mm., all larvae of both species alive at the end of the period of treatment died during the next two days. Fumigation with methyl bromide at the rate of 2–3 oz. per 50 cu. ft. for 3 hours at an initial vacuum of 700 mm. and subsequent vacuum of 20 mm. gave a complete kill.

BRÉMOND (P.). **Le faux-tigre des arbres fruitiers** (*Monostira unicostata* **Muls.**) **au Maroc.**—*Rev. Path. vég.* **25** fasc. 4 pp. 294–307, 16 figs. Paris, 1938.

Monosteira unicostata, Muls. & Rey., which occurs throughout the Mediterranean basin, is annually increasing in importance as a pest of pears in Morocco. All stages, including each of the five nymphal instars, are described. The egg stage lasts from 22 days in spring to 13 in summer, and each nymphal instar about 7 days in spring and 3–4 in summer. Oviposition begins 4–5 days after the last moult. The winter is passed in the adult stage, in cracks in the bark of trees and stakes or more rarely in the soil or under débris. The first adults leave their hibernation quarters about 1st April, when the pear leaves have developed. They may be found singly or in groups of 2–4 along the midrib on the lower surface of the leaves, usually on the side of the tree away from the prevailing wind. They move little unless disturbed. The author considers that reproduction is parthenogenetic, as he never observed pairing, could not find males in spring, and obtained normal oviposition by females isolated from the fifth instar onwards. Eggs are laid in 3–4 batches of 5–15 in the parenchyma along the midrib. In 1938 on the Atlantic coast, the first eggs were laid about 10th April. There were four, at least partial, overlapping generations in the year, all stages being present at once.

In the absence of pear, this Tingid can develop on a number of other food-plants, including apple, quince, plum, cherry, almond, hawthorn, poplar and willow. Injury to pear is caused by the deposition of a film of excrement on the leaves, which prevents respiration, and by the oviposition punctures as well as by feeding, which results in loss of sap and often defoliation. This, in turn, is followed by the death of large numbers of the Tingids, and the trees, free of infestation, produce young leaves and flowers that give rise to fruits that fall with the onset of cold weather and greatly weaken the trees.

The most effective control measure is a spray of 3 lb. pure nicotine, 10 lb. yellow soap and 1 gal. methylated spirit [in 100 gals. water] applied when the first adults appear and subsequently at intervals of 30 days in spring and 25 in summer. This kills all stages except the eggs. Alternatively, the nicotine content of the spray may be reduced to 20 oz., and it may be applied at intervals of 25 days. It is then effective against nymphs only, but is much less expensive.

Winter applications of 8 per cent. anthracene-oil emulsion or of solutions of sodium orthodinitrocresylate destroy many of the hibernating adults.

FREEMAN (P.). **A Contribution to the Study of the Genus** *Calidea* **Laporte (Hemipt.-Heteropt., Pentatomidae).**—*Trans. R. ent. Soc. Lond.* **88** pt. 5 pp. 139–159, 31 figs., 39 refs. London, 1939.

This paper was written in view of the fact that Pentatomids of the genus *Calidea* have been found to transmit fungi causing boll-rots in cotton. It comprises descriptions of the genus and of all species represented in the collection in the British Museum, with a key to the species and records of their synonymy and distribution, which is confined to the Ethiopian Region, including Madagascar and Arabia. The genitalia provide the most satisfactory characters for the separation of the males. No satisfactory characters have been found for the separation of the females of all species.

Production of Virginia Tobacco in the Union of South Africa.—*Bull. Dep. Agric. S. Afr.* no. 188, 50 pp., text ill., 2 refs. Pretoria, 1938. Price 6*d*.

This bulletin contains a section (pp. 35–45) by A. J. Smith on pests of tobacco in South Africa, which includes brief notes on the bionomics and control of the Aphid, *Myzus persicae*, Sulz. [*cf. R.A.E.*, A **26** 177], and *Phthorimaea heliopa*, Lw., *P. operculella*, Zell., *Lema bilineata*, Germ., cutworms, an Aleurodid [*Bemisia* sp.] and a Collembolan [*cf.* **22** 49]. A section on tobacco diseases (pp. 45–50), by A. F. Hean, includes notes on kromnek, the virus of which is transmitted by a thrips [*Frankliniella* sp. (*cf.* **21** 583)], and leaf curl, which is transmitted by the Aleurodid [*cf.* **23** 692].

MIAO (C. P.). **Study of some Forest Insects of Nanking and its Vicinity, Part I.**—*Contr. biol. Lab. Sci. Soc. China* (*zool.*) **12** no. 8 pp. 131–181, 48 figs., 46 refs. Shanghai, 1937. [Recd. 1939.]

Detailed descriptions are given of all stages and larval instars of three Lepidoptera attacking forest trees in the district of Nanking, together with brief notes on their bionomics. They are the Lasiocampids, *Lebeda nobilis*, Wlk., and *Pyrosis* (*Bhima*) *idiota*, Graes., which are polyphagous, but particularly injurious to oaks, and *Papilio xuthus*, L., which attacks *Zanthoxylum* spp. and *Poncirus trifoliata*.

KAWANO (T.). **Studies on a new Method of Rice Storage.** [*In Japanese.*]—*J. agric. Sci. Tokyo Nogyo Daigaku* **1** no. 2 pp. 101–140, 3 pls. Tokyo, 1939.

In Japan, stored rice is attacked by many insect pests, of which the most important are *Calandra oryzae*, L., *C. sasakii*, Tak., *Rhizopertha dominica*, F., *Plodia interpunctella*, Hb., and *Aphomia gularis*, Zell. Near Tokyo, the species of *Calandra* usually breed from mid-May to late October (at temperatures above 16–17°C. [60·8–62·6°F.]). Temperatures above 24°C. [75·2°F.] are the most favourable, about 30°C. [86°F.] being the optimum. Both the eggs and larvae develop at temperatures above 15°C. [59°F.]. *R. dominica* appears unable to

breed at 15°C., and the adults survive for only 3 months at 10°C. [50°F.]. The optimum is 32–34°C. [89·6–93·2°F.]. Some eggs of *P. interpunctella* hatch at about 15°C., but very few larvae survive. At 30°C., a generation is completed in a month. It is concluded that, in order to avoid infestation and the necessity of fumigation, rice should be stored at a temperature of 15°C. or a little lower.

NAWA (U.). **Control Methods for** *Cacoecia xylosteana* **L., a Pest of Pear.** [*In Japanese.*]—*Insect World* **43** no. 4 pp. 102–105. Gifu, Japan, 1939.

Descriptions are given of all stages of *Tortrix* (*Cacoecia*) *xylosteana*, L., which has one generation a year in Japan, where it is of importance as a pest of pear and also attacks apple and cherry. The eggs overwinter and hatch in April. The larvae first feed on the buds and then on the leaves, which they roll, and occasionally on the fruits. They pupate in the last half of May or in June, and the adults emerge 5–10 days later. Collecting the eggs and spraying with lead arsenate are recommended for control.

KARIYA (S.). **Conditions of important Insect Pests in Manchuria in 1938.** [*In Japanese.*]—*Insect World* **43** no. 4 pp. 107–112. Gifu, Japan, 1939.

Brief notes are given on the more important insect pests observed in Manchuria, including *Pyrausta nubilalis*, Hb., *Cirphis unipuncta*, Haw., wireworms attacking wheat, *Gryllotalpa africana*, P. de B., *Cydia* (*Grapholitha*) *glycinivorella*, Mats., *Lema oryzae*, Kuway., *Aphis gossypii*, Glov., *Epilachna vigintioctomaculata*, Motsch., and *Pieris rapae*, L.

MORIMOTO (S.). **The Host Selection of** *Callosobruchus chinensis* **L.** [*In Japanese.*]—*Oyo Kontyû* **1** no. 4 pp. 160–168, 1 fig. Tokyo, 1939.

Females of a strain of *Bruchus* (*Callosobruchus*) *chinensis*, L., that had been reared on *Phaseolus radiatus* for over 70 generations showed no acquired preference for it in comparison with *Vigna sinensis*, soy beans and peas. They oviposited indiscriminately on all these plants, though very few larvae reached the adult stage on soy beans.

KOYAMA (T.). **Structural Characters and Bionomics of** *Paraluperodes suturalis nigrobilineatus* **Motsch.** [*In Japanese.*]—*Oyo Kontyû* **1** no. 4 pp. 169–176, 5 figs. Tokyo, 1939.

The adults of *Monolepta* (*Paraluperodes*) *nigrobilineata*, Motsch., all stages of which are described, feed on the leaves of leguminous plants in Japan and are especially injurious to young soy beans. In Akita Prefecture, northern Honshu, this Galerucid probably has two generations a year, the adults of which emerge from late July to late August and from late September to mid-October. The overwintered beetles appear on soy beans in late May or early June, and descend into the soil, where they oviposit on the roots, from mid-June to late July. In captivity, however, the eggs were laid on glass and on the

leaves and stalks of the food-plant. Females lay 234 eggs on an average in spring, and more in autumn, at an average rate of 3·7 a day. Overwintered adults may survive up to the end of August, and those of the summer generation until the end of November. The eggs hatch in a week, and the larvae bore into the root nodules, attacking up to 10 during their development. Pupation occurs in lumps of earth, and the pupal stage lasts 10 days in late July or early August. The adults of the summer generation oviposit until early September, and those of the overwintering generation feed in autumn, but do not pair before hibernation, which takes place under fallen leaves and stalks.

NAKAYAMA (S.). **Effect of Temperature upon the Post-embryonic Development of *Brachmia macroscopa* Meyrick, a Pest of Sweet Potato.** [*In Japanese.*]—*J. Plant Prot.* **26** no. 3 pp. 159–161. Tokyo, 1939.

In Korea, the Tineid, *Brachmia macroscopa*, Meyr., causes considerable damage to sweet potato in summer and autumn. The duration of the life-cycle from oviposition to adult emergence averages 33 days between late May and mid-July (at about 22°C. [71·6°F.]), 23 days from mid-July to early August (at 26–28°C. [78·8–82·4°F.]), 24 days between mid-August and mid-September (at 20–30°C. [68–86°F.]) and 47 days between late August and late October (at 15–27°C. [59–80·6°F.]). Humidity has no apparent effect on development.

NAKAYAMA (S.). **Observations on the Causes of increased Generations of *Epilachna vigintioctomaculata* Motsch. in Korea.** [*In Japanese.*] —*J. Plant Prot.* **26** no. 4 pp. 240–243. Tokyo, 1939.

The Coccinellid, *Epilachna vigintioctomaculata*, Motsch., has three generations a year in Korea, but only one or two in Japan. Near Suigen, in Korea, it feeds on 16 species of plants, mainly Solanaceae, Cucurbitaceae and Leguminosae, but the larvae do not mature on cucurbits. Egg-plant [*Solanum melongena*], potato and *Solanum nigrum* are the preferred food-plants, and three generations can be completed on all of them. The longer days in May and in September–October, the higher temperatures in May and June, and the presence of alternative food-plants after potatoes are dug, may facilitate the completion of the third generation near Suigen.

ESAKI (T.) & SAMESHIMA (T.). **Report on the Leafhoppers injurious to the Rice Plant and their natural Enemies, no. 9 (for the Year 1938).** [*In Japanese.*]—74 pp., 7 pls., 2 figs. Hukuoka, Dep. Agric., Kyushu Imp. Univ., 1939.

Records similar to those of previous years [*R.A.E.*, A **26** 439] are given of the prevalence of Jassids and Delphacids on rice near Fukuoka in 1938; *Nephotettix bipunctatus cincticeps*, Uhler, was more abundant than usual. Egg-masses of *Nephotettix*, *Delphacodes striatellus*, Fall., *Sogata furcifera*, Horv., and *Nilaparvata oryzae*, Mats., contained up to 16, 7, 9 and 6 eggs, respectively. The eggs and the process of oviposition in these species are described, and brief notes are given on their natural enemies. Experiments on the transmission of dwarf disease of rice by *Nephotettix* were continued. The symptoms appeared first on the leaves or stalks attacked by the infected Jassids and then on the adjacent side shoots.

Takana (S.) & Yanagihara (M.). **Researches on injurious and beneficial Insects and other injurious Animals of Sugar-cane.** [*In Japanese.*]—*Sug. Exp. Sta. extra Rep.* no. 2, 311 pp., 18 col. pls., 7 figs., index 20 pp. Tainan, Formosa, 1939.

The first part of this work comprises a popular account of insect morphology and ecology and of control methods, including insecticides, and in the second, descriptions are given of about 240 of the more important insect pests of sugar-cane in Formosa, with notes on their bionomics, the injury they cause and their natural enemies. Much of the information is from the literature.

One of the most important pests is *Gryllotalpa formosana*, Shir., which occurs in dry sandy soil throughout the island, but is commoner in the central and southern districts. It has one generation a year; the adults emerge in March and April, females oviposit after rain from April to July, and the eggs hatch in 12–14 days. The nymphs moult 9–11 times, and become adult after about 10 months. Adult life averages 77 days for males and 100 for females. The latter deposit an average of 53·3 eggs in 5·7 masses. The life-history of *G. africana*, P. de B., is similar, but it prefers a damp environment and feeds on young canes and the subterranean parts of older cane. The adults and late-instar nymphs are most injurious from September to April or May.

Considerable injury is caused to sugar-cane throughout the island by *Melanotus tamsuyensis*, Bates. Females of this Elaterid deposit 200–300 eggs in the soil, and the larvae, which hatch in about 3 weeks, also feed on the roots of *Miscanthus* and other grasses. The larval and pupal stages last 2–3 years and 18–30 days, respectively. Pupation occurs from October to December, and the adults appear above the ground soon after emergence where the mean temperature in winter is above 20°C. [68°F.], but remain in the soil for some months in cooler districts. The adults are active at night, but remain motionless among the leaves during the day. Outbreaks of *Lachnosterna* (*Holotrichia*) *horishana*, Niijima & Kinoshita, occurred in central Formosa in 1914 and 1925–26. The adults appear above ground in April and May, and feed on the leaves of sugar-cane, bamboo, *Miscanthus* and other grasses. The eggs are laid in May and June, and the larvae, which hatch in about 8 days, pupate in September and October, the pupal stage lasting a fortnight. *Anomala expansa*, Bates, has one generation a year; the adults are present from April to October and commonest from May to July. Females lay 54–87 eggs, which hatch in 13–19 days. The larvae feed on the roots of sugar-cane and pupate after 8–10 months. The pupal stage lasts 14–19 days. The food-plants of the adults include mango, *Ficus retusa*, *Crotalaria*, *Acacia* and *Sesbania*, and they are scarce where these plants are absent or rare. *Oryctes rhinoceros*, L., which has one generation a year, is primarily a pest of palm trees, but the adults occasionally bore into the stems of sugar cane.

Spodoptera mauritia, Boisd., which has 7–8 generations a year, is sometimes numerous in rice-fields and on *Sesbania*, and migrates from them to sugar-cane. It also feeds on *Cyperus rotundus*. The larvae are parasitised by *Cnephalia* (*Gonia*) *cinerascens*, Rond.

The moth-borers attacking sugar-cane are *Diatraea venosata*, Wlk., *Chilo infuscatellus*, Sn., and *Eucosma schistaceana*, Sn. The ant, *Tetramorium guineense*, F., which sometimes fosters Aphids and Coccids

and is commonest in the centre and north of the island, attacks the larvae of the borers, and, in one district, it is distributed in sugar-cane fields in pieces of bamboo for their control. *Telenomus* (*Phanurus*) *beneficiens*, Zehnt., parasitises up to 34·9 per cent. of the eggs of *Diatraea* near Tainan, while *Trichogramma australicum*, Gir., parasitises up to 63·8, 30 and 19·8 per cent. of the eggs of *Diatraea*, *Chilo* and *Eucosma*, respectively.

Sison (P.). **Some Observations on the Life-history, Habits, and Control of the Rice Caseworm,** *Nymphula depunctalis* **Guen.**— *Philipp. J. Agric.* **9** no. 3 pp. 273–301, 4 pls., 1 fig., 14 refs. Manila, 1938.

Studies on the bionomics and control of the Pyralid, *Nymphula depunctalis*, Gn., a serious pest of rice in the Philippine Islands, were carried out in and near Manila during 1934–36. Its distribution in south-eastern Asia is summarised from the literature, and all stages are described. The larvae occur on all varieties of lowland rice, and also on grasses of the genera *Panicum*, *Eragrostis* and *Paspalum*, which grow on the rice dykes and of which *Panicum carinatum* is preferred. They feed on the lower surfaces of the leaves and live in cases made of pieces of leaf. Seedlings of all ages are attacked ; the leaves wither and fall, and even if the plant recovers, it becomes stunted, and produces smaller panicles than uninfested plants. Older seedlings recover more readily than younger ones, and mature plants, the leaves of which are tough, are not attacked. Infestations occur in patches varying greatly in size.

The rearing techniques used in laboratory studies are described. Under experimental conditions, the egg, larval and pupal stages lasted 2–6, 14–20 and 4–7 days, respectively. The adults lived for 2–8 days, and females oviposited 1–4 days after emergence. The number of eggs laid per female varied from 3 to 103, and averaged 52·2 for ten females ; of these, four oviposited twice. The number of developed eggs in the ovaries after death varied from 0 to 93, with an average of 28·9. The sexes occurred in about equal numbers.

The adults are nocturnal and are attracted to lights ; by day they shelter under the leaves of rice and other grasses, often in association with *Cnaphalocrocis medinalis*, Gn. The eggs are deposited in batches of up to 21 on the lower surfaces of the leaves and on the stems of rice and other grasses, a little above the surface of the water ; they have also been found attached to empty larval cases floating in the rice-fields. The larva begins to feed on the day it hatches and constructs its first case after two days. It makes a new case before each moult. It pupates in its case on a stem or other object slightly above the surface of the water. Breeding occurs on rice from July to November and on grasses in the rice-fields and in other places where water is permanently present during the rest of the year. Of larvae collected in October–November, 6·37 per cent. were parasitised by a hairworm, possibly a Mermithid, which prevents pupation. The larva of a species of *Tabanus* was predacious on the larvae, and the ant, *Solenopsis geminata*, F., attacked both larvae and pupae.

In field trials, draining the fields, applying kerosene to form a film on the water, and dusting the rice with calcium arsenate gave average mortalities of 49·2, 23·06 and 31·65 per cent., respectively, in 2–3 days. In laboratory tests in which larvae and grass were placed in dishes

containing water about 2 mm. deep with a surface area of about 1,100 sq. cm., and derris powder (rotenone content 3·09 per cent.) was applied as a dust, 0·2 gm. powder killed all of 22 larvae in about 5 hours, and 0·13 and 0·1 gm. each killed all of 25 in about 22 hours. When derris powder was stirred into the water at the rate of 0·1 and 0·05 gm. per litre, all the larvae (20 in each test) were killed after 4 and 5 hours, respectively.

Calinisan (M. R.). **Transmission Experiments of Abaca Mosaic (Progress Report No. 1).**—*Philipp. J. Agric.* **9** no. 3 pp. 309–313, 3 pls., 5 refs. Manila, 1938.

A mosaic disease of Manila hemp (*Musa textilis*), first observed in the Province of Davao, Philippines, in 1933, has now become one of the major diseases of this plant. In laboratory experiments carried out at Manila in 1933, the disease was not transmitted by infected soil, by contact with diseased roots or leaves, by soaking seeds or seedlings in juice from infected plants or by artificial inoculation in various ways. In 1935, when healthy plants were grown side by side with diseased plants infested by the Aphid, *Pentalonia nigronervosa*, Coq., all but one became infected, and the Aphid was found on all the infected plants. No other insect was present.

Smith (J. H.). **Pests of the Grape Vine.**—*Qd agric. J.* **50** pt. 6 pp. 700–707, 7 figs. Brisbane, 1938.

The commoner pests of the grape vine in Queensland are discussed in order of their importance there. They comprise *Phylloxera vitifoliae*, Fitch [*cf. R.A.E.*, A **21** 276; **26** 608]; *Dacus* (*Chaetodacus*) *ferrugineus tryoni*, Frogg., which causes severe losses in years when it is abundant, though grapes are not favourite host-fruits and the larvae seldom complete development in them; *Haplothrips froggatti*, Hood, which attacks the young growth in spring, causing flower drop, faulty setting and occasionally leaf-fall and malformation in the growing-point, and may be controlled by at least 2 applications of a spray of ½ pint nicotine sulphate, 2 lb. soft soap and 50 gals. water, or a dust containing not less than 2 per cent. nicotine; mites, including *Eriophyes vitis*, Land., *Phyllocoptes* sp., and *Tenuipalpus* sp., against which a lime-sulphur spray (1 part concentrate with a polysulphide content of not less than 16 per cent. to 10 parts water) should be applied before the buds begin to swell; the Coccids, *Saissetia nigra*, Nietn., and *Lecanium persicae*, F., with which sooty mould is usually associated; the Sphingids, *Hippotion celerio*, L., and *Theretra oldenlandiae*, F.; the Agaristids, *Phalaenoides glycinae*, Lewin, and *Agarista agricola*, Don.; and the Galerucids, *Monolepta rosea*, Blkb., and *M. divisa*, Blkb.

Lever (R. J. A. W.). **Economic Insects in some western Pacific Islands.**—*Agric. J. Fiji* **9** no. 4 pp. 11–12. Suva, 1938.

As a result of the introduction from Fiji into Tahiti in 1937 of *Plaesius javanus*, Er., against *Cosmopolites sordidus*, Germ. [*R.A.E.*, A **27** 212], the damage caused by the weevil to banana is decreasing. Consignments of the fruit-fly parasites, *Tetrastichus* [*giffardianus*, Silv.], *Dirhinus* sp. and *Syntomosphyrum* [*indicum*, Silv.], were sent in 1937 and 1938 to the Cook Islands and western Samoa; the fruit-fly in the latter is a species of *Dacus* (*Chaetodacus*) attacking *Citrus*.

The colony of *Teleonemia lantanae*, Dist. (which the author regards as a synonym of *T. scrupulosa*, Stål), sent to Tonga in 1937 to control *Lantana* [*loc. cit.*], is definitely established. An attempt to introduce *Liothrips urichi*, Karny, into the Solomon Islands for the control of *Clidemia* [**26** 703] was unsuccessful; a few were liberated on the Shortland Islands. Consignments of *S. indicum* and the Coccinellid, *Cryptognatha* [*nodiceps*, Mshl.], were sent to Hawaii for the control of *Dacus* and the Coccid, *Pinnaspis buxi*, Bch., respectively.

It is stated that the Dynastid, *Papuana huebneri*, Frm., which was introduced accidentally into the Gilbert Islands and attacks banana and taro (*Colocasia*), is increasing in numbers; paradichlorobenzene was recommended for its control.

Lever (R. J. A. W.). **Entomological Notes.**—*Agric. J. Fiji* **9** no. 4 pp. 12–18, 2 maps, 15 refs. Suva, 1938.

An account is given of the collection of the Eulophid, *Pleurotropis* [*parvulus*, Ferrière], in the Lau Islands, Fiji, where it was difficult to find owing to the suppression by it of its host, *Promecotheca reichei*, Baly [*cf. R.A.E.*, A **25** 588], and of the successful sending of consignments of this parasite to New Britain (via Sydney) for the control of *P. papuana*, Csiki, on coconut [*cf.* **25** 742] and to Tonga (via Auckland) against *P. reichei*. A previous attempt to introduce it into New Guinea from the New Hebrides, where it was introduced from Java in 1937 against *P. opacicollis*, Gestro, had failed. In investigations in Suva at a mean daily temperature of 71–81°F., development lasted 19–25 days in *P. reichei*, which was recorded as attacking ivory nut palm (*Metroxylon*) on Viti Levu. Characters are given distinguishing the sexes of the Eulophid; for practical purposes they can be distinguished by the positive phototropism of the female.

With reference to fruit-flies in Fiji, the author states that records of *Dacus* (*Chaetodacus*) *psidii*, Frogg., there are erroneous, that *D.* (*C.*) *curvipennis*, Frogg., which attacks banana, is rare [*cf.* **4** 152] and that *D.* (*Notodacus*) *xanthodes*, Broun, is much less numerous than *D.* (*C.*) *passiflorae*, Frogg. The latter was taken on *Chrysophyllum cainito* in 1929. Investigations in 1938 showed that on cucumber at 71–81°F. the larval and pupal stages last 7–10 and 9–11 days, respectively; they were longer on fruits of *Inocarpus*, cotton bolls and sandal seed. The Chalcidoid bred from pupae of *Dacus* (*Chaetodacus*) [**26** 59] has been identified as the Pteromalid, *Spalangia cameroni*, Perkins; it has also been bred from *Musca domestica vicina*, Macq.

The chief insect pests of books in Fiji are *Lepisma saccharina*, L., *Supella supellectilium*, Serv., and the Anobiid, *Catorama herbarium*, Gorh., which was previously erroneously identified as *Sitodrepa panicea*, L. [**9** 481] and is parasitised by a Bethylid of the genus *Sclerodermus*. Books can be effectively protected from insect attacks by a repellent paint that is easier to prepare than one already noticed [**18** 617] and is not poisonous. It consists of 1 oz. resin, 2 oz. shellac, $\frac{1}{8}$ fl. oz. creosote, 1 pint methylated spirit and enough methyl salicylate to give a perceptible odour.

Pemberton (C. E.). **Entomology.**—*Rep. Comm. Exp. Sta. Hawaii. Sug. Pl. Ass. 1938* pp. 19–29. Honolulu, 1938.

An account is given of work carried out in Hawaii during the year 1937–38. *Anomala orientalis*, Waterh. [*cf. R.A.E.*, A **25** 613] was

observed on plants other than sugar-cane, and in unirrigated soil, for the first time in Hawaii in May 1938, when a moderate infestation of pineapple growing near sugar-cane in soil moderately favourable to the species was reported on Oahu. As many as 22 second- and third-instar larvae were found about a single plant, most of them deeper in the soil than is usual in cane fields. *Campsomeris marginella modesta*, Sm., and *Tiphia segregata*, Crwf., were present in all areas known to be infested by *A. orientalis*.

Rhabdocnemis obscura, Boisd., damages the softer canes, such as POJ 2878, when they are harvested in 2-year cycles, even where the Tachinid [*Ceromasia sphenophori*, Villen.] is abundant, and also damaged 28–2055 cane on Kauai, where conditions seem to be unfavourable for this parasite. During studies of infestation on Oahu [*cf.* **27** 90], no evidence of definite seasonal fluctuations in borer population was found. The drift of adults from one field to another, and particularly from fields being harvested, appeared to account in part for borer infestation, and since marked adults were taken at distances of up to 650 ft. down wind, and up to 150 ft. across wind, from the point of release in an abandoned field, it appears that migration takes place even from undisturbed cane.

Large colonies of the Blattid, *Diploptera dytiscoides*, Serv., have been destroyed by dusting with a mixture of equal quantities of sodium fluoride and chalk or flour, and this dust has proved promising for its control on coconut palms. It is also effective against house cockroaches. *Macrosiphum* (*Aphis*) *avenae*, F., which has never been recorded as a pest of sugar-cane and had only once previously been observed in Hawaii, was found on the roots of a water culture of cane variety 31–2538. The Nitidulid, *Carpophilus humeralis*, F., occurred locally in large numbers in sugar-cane fields on Oahu in January and, although living chiefly in decaying vegetable matter, also attacked seed pieces that were slow in germinating, and may possibly have killed some of them.

In 1937, freshly planted seed potatoes were attacked by larvae of *Dasus* (*Gonocephalum*) *seriatus*, Boisd., and germinating cane shoots as they grew through a layer of infested filter cake, by *Eutochia lateralis*, Boh. Neither of these Tenebrionids is usually regarded as injurious to crops.

Apanteles scutellaris, Mues., introduced against the potato tuber moth [*Phthorimaea operculella*, Zell.] some years ago, was recovered in considerable numbers on Oahu, and *Cremastus flavoorbitalis*, Cam., a parasite of the coconut leaf-roller [*Lamprosema blackburni*, Btlr.], was collected there for distribution to other islands. Several shipments of the two insects that infest nutgrass (*Cyperus rotundus*) in Hawaii [*Bactra truculenta*, Meyr., and *Athesapeuta cyperi*, Mshl.] were made to Australia and Fiji. *Cryptogonus orbiculus* var. *nigripennis*, Weise, introduced on Kauai against *Pinnaspis buxi*, Bch., is now well established, and is being distributed to other localities in Hawaii where this scale is damaging coconut palms. *Microbracon chinensis*, Szép. (*Amyosoma chilonis*, Vier.), introduced in 1928 [**17** 194] for the control of the rice borer [*Chilo simplex*, Btlr.] is established on Kauai and Oahu. The Agaonid, *Eupristina verticillata*, Wtstn., introduced from the Philippines and China between February and May 1938 to pollinate the Chinese banyan, *Ficus retusa*, has become established on several trees in Honolulu.

In April, the nutgrass armyworm, *Laphygma exempta*, Wlk. [*cf.* **26** 692], caused some injury to sugar-canes on Oahu and Hawaii. On Oahu it had disappeared by May, probably owing to the development of parasites and the use of weed spray. On Hawaii, parasites were not sufficient to control the outbreak, though they increased rapidly, but almost all the caterpillars in some districts were destroyed by the fungus, *Metarrhizium anisopliae*. Tests indicated that the arsenical spray that is used to kill weeds and is commonly applied for the control of *L. exempta* was effective against the latter on sugar-cane at dilutions much weaker than those used against weeds, although it scorched the canes to some extent ; larvae sprayed once with a 1 : 225 dilution and confined on nutgrass that had been sprayed lightly died within 36 hours. A dust of arsenic and raw rock phosphate [*cf.* **21** 16, 347] sometimes gives economic control. Of 1,000 larvae fed on leaves dusted with this mixture in the laboratory, all died within 2 days. Magnesium sulphate (Epsom salts) was ineffective in baits and sprays against *L. exempta*.

The numbers of insects taken in 38 east-bound aeroplanes at Midway in 1937 during quarantine inspections totalled 627, all but one of which had been killed by spraying while the aeroplanes were in flight. In June 1938, a dead adult of the injurious sugar-cane beetle, *Leucopholis irrorata*, Chevr., was taken in an aeroplane from the Philippines.

Seamans (H. L.) & Farstad (C. W.). *Agropyron smithii* **Rydb. and** *Cephus cinctus* **Nort.**—*Ecology* **19** no. 2 p. 350. Brooklyn, N.Y., 1938.

In this note, the authors state that although *Agropyrum smithi* would undoubtedly be of value in soil conservation schemes in the prairies of Canada, investigations there have shown that it is a favoured food-plant of the wheat-stem sawfly, *Cephus cinctus*, Nort. Its widespread introduction would therefore lead to an outbreak of the sawfly that would cause losses to growers of both wheat and *Agropyrum*.

Balch (R. E.). **The Spruce Sawfly Outbreak in 1938.**—5 pp., 7 figs., 5 refs. Montreal, Woodlands Sect. Canad. Pulp Pap. Ass., 1939.

The origin and history of the outbreak of *Diprion polytomum*, Htg., on spruce in eastern Canada, and the resultant injury to the trees, are briefly described [*cf. R.A.E.*, A **26** 487], and its known distribution there and in the United States in 1938 is shown on a map. A new infestation was found between Lake Ontario and Georgian Bay, where the sawfly was present in fairly considerable numbers, and one record was obtained from the eastern end of Lake Superior, one from Cape Breton Island, and several from the mainland of Nova Scotia. Mortality of the trees was still practically confined to the Gaspé, where it rose to about 69 and 33 per cent. by volume of white and black spruce [*Picea glauca* and *P. mariana*], an increase of about 4–5 per cent. [*cf.* **27** 275]. In other areas, defoliation was severe and growth was reduced. Methods of making surveys and of classifying infestations are recapitulated [*cf.* **26** 330].

The year 1938 was characterised by a rather rapid disappearance of the snow and the early drying of the ground, followed by a cool period in spring and an abnormally wet summer ; and at all points

where studies were made, the percentage of cocoons that gave rise to adults during the normal period of emergence was very low. In central New Brunswick, where the average annual emergence had been about 70 per cent. for the previous 4 years, most of which occurred before the end of June, it was only 10 per cent. by that date in 1938. Although adults continued to emerge during warm periods until the end of October, the average for the year was only 55 per cent. As a result of late oviposition, many larvae hatched too late to mature before winter. Experiments have indicated that this continued delayed emergence is the result of the soaking of the cocoons by the abnormal rains. At the same time, a tendency to remain in diapause was observed, apparently a result of the heavy attack in 1937. Both defoliation and adult emergence were, in general, distinctly less than in 1937 in the Gaspé and northern New Brunswick, but greater in central and southern New Brunswick. Infestation in other parts of Canada remained fairly light, but in the United States the heavily infested areas in Maine, Vermont and New Hampshire increased. The sudden defoliation of red spruce [*P. rubra*] in Vermont and New Hampshire suggests that in the south, where there are two generations of *D. polytomum* in the year, outbreaks may develop more rapidly.

Although the progress of the outbreak was checked to some extent in 1938, it seems probable that the area of heavy infestation will continue to extend, since parasitism by native species did not exceed 0·02 per cent. and no new control factors were observed. *Microplectron fuscipenne*, Zett., 17 million of which were liberated in comparatively inaccessible areas in New Brunswick, and *Exenterus adspersus*, Htg., continued to increase. Small numbers of *Dendroctonus piceaperda*, Hopk., associated with secondary bark-beetles, were observed on spruce for the first time since 1934 [*cf.* **23** 236], but mainly attacked dying trees.

Brierley (P.) & McKay (M. B.). **Experiments with Aphids as Vectors of Tulip Breaking.**—*Phytopathology* **28** no. 2 pp. 123–129, 9 refs. Lancaster, Pa, 1938.

Experiments were carried out in Oregon in the period 1926–30 on the transmission of tulip breaking by Aphids [*cf. R.A.E.*, A **22** 231, etc.]. The methods used in the tests were allowing colonies of Aphids that had fed on infected tulips for 13–29 days to feed on healthy plants in cages for the remainder of the season, introducing infected Aphids on a tulip into a cage containing healthy tulips, and introducing uninfected Aphids into cages containing both healthy and diseased tulips. The results showed that *Macrosiphum solanifolii*, Ashm., transmitted the disease in 12 of 28 tests and to 14·3 per cent. of the tulips exposed to infection. *Myzus persicae*, Sulz., transmitted it in 7 of 10 tests and to 17·4 per cent. of healthy tulips. In 1 test out of 5, *M. circumflexus*, Buckt., transmitted breaking, but no positive results were obtained with *Macrosiphum solani*, Kalt., *Anuraphis tulipae*, Boy., or *Rhopalosiphoninus staphyleae*, Koch (*tulipaella*, Theo.). When broken and healthy tulips in cages were allowed to become naturally infested with *M. solanifolii*, 22 of 27 healthy plants became infected, but none of a number of naturally infested healthy tulips did so. It is considered that the spread of the disease by natural infestation occurs mostly when the Aphids become established on diseased plants early in the season. In all cases, the symptoms of the disease were observed

only in the season following that in which infection took place. Collections of Aphids from tulip leaves in nature showed that *M. solanifolii* was by far the commonest species. *M. solani* and *Myzus circumflexus* were not taken.

OSBORN (H. T.). **Incubation Period of Pea Virus 1 in the Aphid** *Macrosiphum solanifolii*.—*Phytopathology* **28** no. 10 pp. 749–754, 2 refs. Lancaster, Pa, 1938. **Studies on Pea Virus 1.**—*T.c.* no. 12 pp. 923–934, 9 refs.

Details are given in the first paper of experiments in which, by exposing successions of healthy broad beans (*Vicia faba*) to colonies that had fed for short periods on diseased plants, it was shown that pea virus 1 undergoes an incubation period in the potato Aphid, *Macrosiphum solanifolii*, Ashm. [*cf. R.A.E.*, A **23** 166]. Aphids that acquired the virus were shown to retain it for as long as 21 days when fed continuously on immune plants (tomatos). *Aphis rumicis*, L., failed to transmit the virus.

In the course of the second paper, it is stated that examples of *Macrosiphum onobrychis*, Boy. (*pisi*, Kalt.) transferred from infected broad beans, and allowed to feed on healthy ones at a temperature of 35°C. [95°F.], retained the virus for up to 8 days. The failure to obtain infection after longer periods may have been due to the loss of infective individuals from the colonies [*cf.* **22** 131].

EDDY (C. O.). **Entomological Progress.**—*Bull. La agric. Exp. Sta.* no. 298, 32 pp., 6 refs. Baton Rouge, La, 1938.

This bulletin comprises a collection of brief reports by various authors on insect pests and their control in Louisiana. The information in three of them, by E. K. Bynum, C. L. Stracener, and B. A. Osterberger & M. B. Christian, has already been noticed [*R.A.E.*, A **26** 137; **27** 248].

C. E. Smith describes tests on the control of Lepidopterous larvae on cabbage with substitutes for arsenicals, which leave harmful residues after foliage that will be part of the marketed product is exposed [**25** 467]. Against *Plusia* (*Autographa*) *brassicae*, Riley, a derris dust containing 1·0 per cent. rotenone gave the best control, and one containing 0·5 per cent. rotenone with synthetic cryolite was superior to dusts containing 0·1 and 0·5 per cent. pyrethrin I. Derris dust (1·0 per cent. rotenone) and undiluted calcium arsenate were equally effective against *Plutella maculipennis*, Curt. Derris dusts containing 1·0 and 0·5 per cent. rotenone were the most effective against *Pieris* (*Ascia*) *rapae*, L., the only other comparatively effective treatment being Paris green and lime (1 : 9). Against cutworms, including *Heliothis armigera*, Hb. (*obsoleta*, F.), dusts of Paris green, calcium arsenate and cryolite gave better control than derris or pyrethrum.

An account is given by L. T. Graham and L. O. Ellisor of investigations on the life-history of the Membracid, *Stictocephala festina*, Say, the feeding punctures of which girdle the stems of lucerne, and to a less extent those of soy beans, cowpeas and kidney beans, just above the soil, causing the plants to die. The adults did not hibernate in the two years in which observations were made, but were particularly abundant on lucerne and were also observed on other winter-growing leguminous plants. They continued to feed and lay eggs on warm days throughout the winter, but sheltered on the stems or in crevices, etc.,

near the food-plants on cold days. They gradually died off during the winter, and very few were left when the nymphs appeared in spring. A few nymphs hatched during warm intervals in winter, but were killed by the ensuing cold. The first to survive appeared during the first week in March. The population increased gradually during summer and reached a maximum in the autumn. In the summer, almost all the eggs were laid in the stems not more than an inch above the surface of the soil, but in the winter, 97·6 per cent. were laid more than 2 ins. and 93 per cent. more than 3 ins. above the ground. Thus, harvesting the first crop of lucerne before the main period of hatching begins in the spring would considerably reduce the numbers of the insect and delay severe infestation until late in the season.

B. A. Osterberger records the results of several years' experiments on the control of larvae of the sugar-cane borer [*Diatraea saccharalis*, F.] overwintering in sugar-cane tops, by burning the top trash at different times during the winter, and using fertilisers or covering it with varying amounts of soil to hasten its deterioration. Fertilisers had no effect on deterioration, but tops covered lightly with soil deteriorated more rapidly than those covered completely. Some cane tops were burnt when green, some were pulled on the ridges to dry before burning, while others were burnt late in January. The percentage mortalities of all stages averaged 21·8 for poor burns, 54·4 for fair burns, 93·6 for very good burns and 17 for unburnt material [*cf.* **22** 653].

P. K. Harrison gives the results of field experiments with a dust of nicotine sulphate and lime, containing 3 per cent. nicotine, and one of derris diluted with equal parts of finely ground tobacco dust and 300-mesh dusting sulphur to give a rotenone content of 1 per cent., against *Rhopalosiphum pseudobrassicae*, Davis, on turnip. The nicotine dust was the more effective for heavy infestations, as it gave an immediate kill ; the derris dust gave equally good control, but was slower in its action. As the latter also destroys leaf-eating pests, and need be applied only once every 10 or 14 days, it is probably more suitable for the grower than nicotine, which should be applied weekly. China clay, sulphur, talc, flour or tobacco dust alone, but not lime, may be substituted for tobacco dust and sulphur as a carrier. The dusts should be applied to the lower surfaces of the leaves with a dust gun at the rate of 15–25 lb. per acre, the derris in the early morning or late afternoon when the dew is on the plants, and the nicotine between 10 a.m. and 2 p.m., after the dew has dried. Treatments should begin as soon as most of the plants have started to grow, and continue throughout the period of growth, and all crop refuse should be ploughed under or destroyed immediately after harvest.

L. O. Ellisor reports on investigations in the autumns of 1936 and 1937 on the bionomics and control of *Anticarsia gemmatalis*, Hb., on soy beans [*cf.* **18** 678]. This Noctuid does not overwinter in the United States, except possibly in the extreme south of Florida, but the adults migrate from the south each year. The larvae usually occur in Louisiana at the beginning of August, but do not become sufficiently numerous to cause serious defoliation of soy beans until mid-August or early September. In 1936, adults, eggs and larvae of the first, second and third instars were observed on 6th August, so that adults must have been in the field by about 27th July. The results are given of field experiments on control with dusts of synthetic cryolite, alone or with an equal quantity of talc, in 1937 [*cf.* **27** 258]. Only one application of the dust was necessary to give seasonal control,

as the infestation did not develop rapidly and serious damage was not general. Beans grown for seed should be planted alone, for ease of control and harvesting. No safe control for *A. gemmatalis* on beans grown for forage is yet known.

S. S. Sharp & C. O. Eddy give a list of 44 species of thrips known to occur in Louisiana, of which 35 have not previously been recorded from that state. The most destructive are *Frankliniella tritici*, Fitch, on flowering plants, seedling cotton and possibly strawberry, *F. fusca*, Hinds, on seedling cotton, onion and cabbage, and *Thrips tabaci*, Lind., on onions, shallots, and sometimes cotton. *Leptothrips mali*, Fitch, is predacious on other thrips, Aphids and the eggs of the pecan nut case-bearer [*Acrobasis caryae*, Grote].

The eggs, larvae and adults of the vegetable weevil, *Listroderes obliquus*, Klug [*cf.* **25** 291] and its bionomics in Louisiana are described by I. J. Becnel. No males of this species have ever been found. It is polyphagous and causes injury to many kinds of vegetables, a list of some of which is given. The eggs are laid singly on the soil near the base or in the crown of a food-plant, and the larvae, which hatch in 9–24 days at 60–70°F., feed at night on the tender foliage in the crown. After 10–12 days, they drop to the ground, burrow into the soil and construct their pupal cells. The prepupal stage lasts several days, and the pupal stage, which varies in length under field conditions, lasted 9–12 days in the laboratory. When the adults emerge, they feed heavily until late April or early May, after which they aestivate under loose bark or splinters on trees or posts or under débris near infested fields. They oviposit in the autumn, and continue to feed and lay eggs at night throughout the winter, except during cold periods, spending the day near the bases of the plants. They are very active on cool nights, but many are killed at freezing point. It is not known whether they die in the spring or aestivate for a second summer. In the case of heavy infestations, plants may be defoliated, but as the weevils seldom if ever fly, but migrate by crawling, injury may be prevented by a suitable rotation of crops, by thorough and repeated cultivation from January to April, and by ploughing the soil and leaving it fallow after the autumn or winter harvest. Aestivation shelters should be destroyed, and in spring new crops should not be planted near those that are infested. A mixture of calcium arsenate and lime (2 : 1) applied at the rate of 10–12 lb. per acre, or cryolite at 7–8 lb. per acre, gives effective control of the weevils on tomatos and potatoes.

J. W. Ingram and L. O. Ellisor summarise the results of a survey made during the harvest season of 1936 to determine the extent of injury to sugar-cane by *Diatraea saccharalis*, F., and compare them with those of 1935. A statistical analysis of joint infestation in 10 districts showed no significant differences between the infestations observed in varieties Co. 281 and Co. 290, or between those in canes growing on light and heavy soils. The percentage of joints bored averaged 8·7 (as compared with 8·1 in 1935), and it is calculated that in 1936 the crop loss due to injury by *D. saccharalis* was 9·08 per cent.

Investigations in 1936 described by L. O. Ellisor and H. A. Jaynes on the percentages of joints of sugar-cane of different varieties bored by *D. saccharalis* [*cf.* **23** 276] showed significant differences for plant cane but not for first-year stubble.

Research during the past two years on the development of a calcium arsenate less destructive to plant tissues and with better adhesion than the regular form, with particular reference to the control of the

soy-bean caterpillar [*Anticarsia gemmatalis*, Hb.] on soy beans, is discussed by C. O. Eddy. Tests against individual insects with a basic calcium arsenate, which contains less than the 15–25 or even 30 per cent. of uncombined lime normal in regular calcium arsenate, and therefore less water-soluble arsenic, showed that it had a lower toxic value than the usual form, but in field experiments it was often found to be equally effective, owing to its better adhesive properties. Most gross-feeding insects were killed by the regular calcium arsenates before they had completed one feeding, but they usually fed several times before the basic forms gave similar control. Experiments still in progress showed that the addition of zinc hydroxide, freshly precipitated Bordeaux, basic copper sulphate, freshly precipitated aluminium hydroxide or similar materials to sprays of calcium arsenate increased their safety on plants, usually without reducing their toxicity. An adhesive with a soy-bean flour base showed promise.

A brief account is given by A. L. Dugas of the bionomics and control of *Phyllotreta vittata discedens*, Weise, of which the larva, pupa and adult are described. This flea-beetle causes considerable damage to the seedlings of cruciferous plants in Louisiana, and sometimes injures well-advanced turnips or mustard. The adults feed on the leaves, and the larvae tunnel the underground parts or feed on their surfaces. Up to 25 larvae have been observed in a single turnip. The eggs are laid in the soil round the food-plant, and the egg, larval and pupal stages last about 5, 20 and 3 days, respectively. Newly emerged adults feed and pair, and females oviposit 8–12 days after emergence. They migrate very little, except in search of a new food-supply. The Braconid, *Perilitus epitricis*, Vier., parasitises the adults, but is not numerous. The immature stages are destroyed by hoeing and cultivation of the soil, and effective control of the adults is given by a derris dust containing 1 per cent. rotenone, applied weekly as long as necessary. Clean harvesting prevents further feeding and reproduction.

In experiments begun in 1937, an account of which is given by C. O. Eddy, dusts of calcium arsenate, cryolite and barium fluosilicate, applied to the stems or leaves of sweet potato in the insectary, gave practically complete control of the sweet-potato weevil [*Cylas formicarius*, F.] in 2–3 days. They were more effective when applied to the lower surfaces of the leaves than to the upper. Derris (0·75 per cent. rotenone), pyrethrum, basic copper sulphate and other dusts were less effective. When dusts were applied to the tubers to kill the adults before they oviposited, a relatively larger amount was used, and 5–10 per cent. of a commercial adhesive, consisting mostly of soy-bean flour, was added. The same poisons were tested, and it was found that results similar to those on the plants were given by calcium arsenate and the fluorine compounds, and that comparable control was obtained with derris (1 and 4 per cent. rotenone) and pyrethrum, which should be applied if the tubers are to be used for food. Many immature weevils were killed as they emerged from the treated tubers. Biological data, obtained under outdoor conditions, showed that all weevils would emerge in December or early January from tubers dug by 1st October, but that eggs laid after 15th October would not give rise to pupae by 1st February. Thus, tubers that are to be left out of doors and dusted should be dug and treated by about 1st October, so that the adults will emerge before the tubers are planted in mid- or late February. It is also suggested that as the weevils are readily attracted to tubers, dusted tubers might be used as a bait in the field.

Jones (E. T.). **Differential Resistance to Chinch-bug Attack in certain Strains of Wheat.**—*Trans. Kans. Acad. Sci.* **40** pp. 135–142, 1 fig. Topeka, Kans., 1938.

In the autumn of 1934, large numbers of chinch bugs [*Blissus leucopterus*, Say] migrated from *Sorghum* to experimental plots of winter wheat in Kansas. The bugs overwintered, and resumed feeding early in March, but were destroyed by heavy rain in May. Injury was first observed on 20th March, and examination of plants of 168 strains in May and June showed that 37 strains were injured lightly or not at all. Lists are given of these, and of the 97 strains classed as injured and the 34 that recovered from moderate or severe injury after the end of the infestation.

Smith (R. C.) & Shepherd (B. L.). **The Life History and Control of the Boxelder Bug in Kansas.**—*Trans. Kans. Acad. Sci.* **40** pp. 143–159, 1 pl., 2 figs., 37 refs. Topeka, Kans., 1938.

The box-elder bug, *Leptocoris trivittatus*, Say, which causes annoyance by entering houses in winter, almost disappeared in Kansas in 1934 as a result of drought, but began to reappear in 1936. Descriptions are given of all stages of this Coreid and of its distribution in Canada and the United States, and the literature on its occurrence in the latter is reviewed. In observations in Kansas, no eggs of the bug were found on box-elder [*Acer negundo*], but early in the season, the rough bark of maples was favoured. There were two generations a year, and in the laboratory the egg and nymphal stages averaged 13·75 and 59·5 days, respectively. Females deposited about 10 eggs, generally all in one day, a fortnight after emerging from hibernation, and none survived for more than 11 days after oviposition. The peak of oviposition in 1933 occurred from 20th April to 10th May. The bug fed on 23 plants, a list of which is given, especially weeds, grasses, and fruits of soft maple. Experiments indicated that it was not cold-resistant, 57 of 185 adults being killed by exposure to 10°F. and the others to −10°F. for two nights, and was easily drowned, especially in the early nymphal instars.

Spiders were the only natural enemies observed. In investigations on control, undiluted kerosene was superior to several other insecticides, and killed 74–90 and 100 per cent. of adults and small nymphs, respectively, under greenhouse conditions, and 60 and 86 per cent. in the field. The best control, however, was given by water, either heated (to 165–180°F.) and thrown on the bugs from a bucket, or cold, applied in large quantities from a hose. Hot-water treatment is recommended against the bugs clustering round the bases of trees and on windows and foundations of buildings, while cold water is effective on vegetation, to which kerosene should not be applied.

Summerland (S. A.). **The Biology and Synonymy of the Parasites of the Strawberry Leaf Roller, *Ancylis comptana* Froel. (Lepidoptera, Tortricidae), found in Kansas.**—*Trans. Kans. Acad. Sci.* **40** pp. 161–178, 118 refs. Topeka, Kans., 1938.

During investigations in Kansas in 1929 on the strawberry leaf-roller, *Ancylis comptana*, Froel., 18 Hymenopterous and 2 Dipterous parasites were bred from the larvae. A list of these is given, together

with their synonyms and distribution and references to them in the literature. They exercised together some control, but no one species predominated. Two hyperparasites were also obtained.

Jones (E. T.). **Parasite Emergence Holes as an Aid in determining Hessian Fly Infestation in mature Wheat Plants.**—*Trans. Kans. Acad. Sci.* **41** pp. 181–182, 1 fig. Topeka, Kans., 1938.

The author states that during work on breeding strains of wheat resistant to the Hessian fly [*Mayetiola destructor*, Say] in Kansas, observations of the emergence holes of parasites of the fly have proved a very reliable indication of infestation. During 1937, rapid selection of resistant hybrids was made by observing the emergence holes of *Merisus destructor*, Say, and *Eupelmus allyni*, French, in the sheaths of infested plants. The correlations between infestation as indicated by this method and by dissection were $0{\cdot}90 \pm 0{\cdot}03$ for plant infestations and $0{\cdot}81 \pm 0{\cdot}03$ for culm infestations.

Smith (R. C.). **A preliminary Report on the Insects attacking Bindweed, with special Reference to Kansas.**—*Trans. Kans. Acad. Sci.* **41** pp. 183–191, 10 figs, 13 refs. Topeka, Kans., 1938.

Waste land and even cultivated fields in Kansas are frequently covered by bindweed. Of the two species that occur, *Convolvulus arvensis* is the more harmful and widespread, but *C. americanus* predominates in eastern Kansas. These weeds are often controlled by spraying with sodium chlorate, but as this method is expensive and renders the soil strongly alkaline, preliminary investigations were carried out in the period 1935–37 on the insects that attack them, with a view to their biological control. The insects found, a list of which is given, were mostly those that commonly feed on weeds. None fed on the roots or stems, and of those attacking the foliage, the most effective were the Tineid, *Bedellia somnulentella*, Zell., which was parasitised by *Apanteles bedelliae*, Vier., and *Spilochalcis albifrons*, Walsh, the Pterophorid, *Oidaematophorus monodactylus*, L., and the Cassidids, *Metriona bivittata*, Say, and *M. bicolor*, F. None was of any great value. It is suggested that an introduced root-feeder would provide the most effective control.

Diseases, Insects, and other Pests Injurious to Plants.—*Bienn. Rep. Kans. agric. Exp. Sta.* **9** (1936–38) pp. 100–111. Manhattan, Kans., 1938.

Lists are given of insects observed in Kansas between July 1936 and June 1938, showing their prevalence. The population of the Hessian fly [*Mayetiola destructor*, Say] was low until the spring of 1938, when it began to increase. More than 1,000 strains of wheat varieties and hybrids were studied each year for resistance to the fly. In the autumn of 1936, 72 per cent. of 326 F_5 Hybrids between the resistant spring wheat, Marquillo, and susceptible winter wheats, all of winter habit, were within the range of infestation of the resistant parent. Shallow-planted wheat had lower infestations of first-generation larvae of *Harmolita grandis*, Riley, than wheat planted deeper. With a light infestation, there was some varietal difference in resistance, but no great difference was found in the degree of infestation

of spring and winter wheat by the second generation. Ecological studies of white grubs [*Lachnosterna*] in a maize field showed a concentration round the roots of the plants. In an adjacent plot of *Sorghum* there was a population of 10–12 larvae to each plant, including *L.* (*Phyllophaga*) *rubiginosa*, Lec. Over 475,000 acres of wheat in the south-central part of the state were very seriously damaged by *L. rubinigosa*, *L.* (*P.*) *crassissima*, Blanch., and *L.* (*P.*) *lanceolata*, Say, the last-named species being the most numerous and destructive. In an experiment in which lead arsenate, applied at the rate of 14 oz. per 100 sq. ft., was worked to a depth of 4 ins. into soil and the soil was placed in flower pots each containing one white grub, the larvae were not killed in three weeks. In tests during 1937 on the tolerance of sweet maize to insecticides used to control the garden webworm [*Loxostege similalis*, Gn.], no significant injury was caused by lead arsenate or Paris green, each at the rate of 4 lb. to 50 U.S. gals. water. Garden crops and flowering plants were attacked severely during 1937 in western Kansas by the carrot beetle [*Ligyrus gibbosus*, DeG.].

Studies were carried out on the life-history of the wing mite of grasshoppers, *Eutrombidium locustarum*, Walsh. The mites feed on grasshopper eggs from early spring to autumn. They enter the soil by dropping from the wings during summer, feed for a short time on grasshopper eggs and other food, and transform to adults, which overwinter.

The first generation of *Gelechia cercerisella*, Chamb., on red bud [*Cercis canadensis*] lasted from the last week in May to 20th July 1937, and the partial third overlapped the second. Identified parasites reared in 1936 were *Haltichella* sp., *Idechthis gelechiae*, Ashm., an undescribed species of *Leucodesmia*, *Macrocentrus ancylivorus*, Rohw., *Tetrastichus coerulescens*, Ashm., and *Xenosternum ornigis*, Mues. Damage by the second generation was severe during July and August 1937, but the insect does not spread rapidly. *Aphis pawneepae*, Hottes, was found on the roots of red-bud trees in September 1936, attended by the ant, *Crematogaster victima missuriensis*, Emery, and above the soil on the under sides of small branches in the spring of 1938.

Observations on *Ancylis comptana*, Froel., on strawberry, showed that the larvae migrate to the lower surfaces of the leaves after hatching and remain under thin webbing for about 7 days before rolling the leaves. Sprays or dusts should be applied during this time. Of 30 insecticides tested, sprays containing nicotine sulphate or pyrethrum extract in combination with summer-oil emulsion, applied three times at intervals of 5 days, gave the best results. Pyrethrum and rotenone dusts gave good control, and sprays of cryolite, or of lead arsenate with summer oil, were effective against the second and third generations. *Crematus cooki*, Weed, was the most abundant of the Hymenopterous parasites of this Tortricid, and the Tachinid, *Nemorilla floralis*, Fall., was also abundant.

STRONG (L. A.). **Report of the Chief of the Bureau of Entomology and Plant Quarantine, 19**[37-]**38.**—84 pp. Washington, D.C., U.S. Dep. Agric., 1938.

An account is given of work on insect pests and their control in the United States during the year ending June 1938, some of which has already been noticed.

Of the parasites of the oriental fruit moth [*Cydia molesta*, Busck] on peach, *Macrocentrus ancylivorus*, Rohw., was the most widely distributed and numerous, but *Glypta rufiscutellaris*, Cress., *Angitia* (*Dioctes*) *molestae*, Uch., *Macrocentrus delicatus*, Cress., *M. instabilis*, Mues., and *Pristomerus ocellatus*, Cush., were also abundant. It was found possible to rear *M. ancylivorus* on the strawberry leaf-roller [*Ancylis comptana*, Froel.] in large field cages. Cage tests and experiments in which wind injury was prevented, carried out in Oregon, proved that russet or scab injury on prunes is caused by the pear thrips [*Taeniothrips inconsequens*, Uzel]. The thrips is also responsible for more serious damage, however, either preventing the fruit from setting or causing it to drop by ovipositing and feeding, leading to total or partial crop failure. Thiodiphenylamine (phenothiazine) gave satisfactory results against the grape berry moth [*Polychrosis viteana*, Clem.], especially when sodium lauryl sulphate was added as a wetting agent, though the deposit was removed to some extent by rain. In Georgia, the hickory shuckworm [*Enarmonia caryana*, Fitch] passed through three generations and a partial fourth in 1937. Overwintered larvae pupated throughout the year, the last adult emerging on 28th December, and about 20 per cent. remained in diapause. In experiments, neither *Macrocentrus ancylivorus* nor *Ascogaster quadridentata*, Wesm., parasitised larvae of this moth. For control of the citrus thrips [*Scirtothrips citri*, Moult.], 3 applications of sulphur dust are sufficient on orange in Arizona, but not on lemon in the coastal area of California. A plot of oranges in California that had been treated with sulphur dusts for two years was practically free from black scale [*Saissetia oleae*, Bern.], whereas untreated trees were still infested.

Work on the biological control of the Japanese beetle [*Popillia japonica*, Newm.] included liberations of the Korean strain of the Scoliid parasite, *Tiphia popilliavora*, Rohw. [**26** 324] in Delaware, Maryland, New Jersey and Pennsylvania ; a strain from Yokohama, of which the adults also appear at a time favourable for parasitism, is being reared. Field plots were successfully infected with the organisms causing milky diseases [**26** 324], and the emergence of adults from them was reduced. Evidence was obtained that these organisms are disseminated by *Tiphia vernalis*, Rohw., and possibly by adults of *P. japonica*. In experiments, spores in diseased larvae eaten by fowls passed through the digestive tract without loss of vitality, and spores of both A and B types remained viable for 25 months in soil, stored under various conditions, from which the larvae were excluded. In Pennsylvania, diseased larvae were recovered in scattered localities several miles from the original infected plots.

An outbreak of the southern pine beetle [*Dendroctonus frontalis*, Zimm.] caused severe damage to loblolly pine [*Pinus taeda*] in eastern Maryland, Virginia and North Corolina, following low rainfall during the spring and summer of 1936, and part of 1937. The forest tent caterpillar [*Malacosoma disstria*, Hb.] caused serious injury to sugar maple [*Acer saccharum*] in Vermont and New Hampshire ; in northern Minnesota, cold weather following early hatching in 1938 caused heavy larval mortality by delaying foliage development. Preliminary studies on the spruce budworm [*Harmologa fumiferana*, Clem.] on ponderosa pine [*Pinus ponderosa*] in Colorado [*cf.* **26** 580] indicated that this apparently new biological strain of the Tortricid is confined to this species of pine ; the growth of infested trees was severely

reduced, and many laterals and terminals were destroyed. During field studies on *Matsucoccus* sp. on ponderosa pine in Arizona, twigs were killed when large colonies of the Coccid were placed upon them ; the tissues of twigs of pitch pine [*P. rigida*] were killed by the injection into them of certain enzymes secreted by the salivary glands of the species of *Matsucoccus* associated with it. Much of the eastern hemlock [*Tsuga canadensis*] that died during the preceding few years in northern Wisconsin and Michigan was infested by the hemlock borer [*Melanophila fulvoguttata*, Harr.], but it is believed to attack only trees that are over-mature or weakened by severe drought. Fewer adults of *Scolytus multistriatus*, Marsh., and *Hylastes* (*Hylurgopinus*) *rufipes*, Eichh., were infected with the fungus causing Dutch elm disease [*Ophiostoma ulmi*] in 1937 than in 1936. Studies on *S. multistriatus* showed that it may be transmitted by physical contact during pairing. The best method of killing undesirable elms in which the Scolytids might breed was to inject an aqueous solution of copper sulphate into the sap during May–September. Galleries were not common in elm stumps. Although surveys were begun earlier and were more intensive, the number of new infections decreased, but new foci of the disease were reported in Ohio and western Virginia.

Studies on *Naupactus leucoloma*, Boh., a serious pest of most kinds of field crops in Alabama, indicated that females deposit up to 1,000 eggs in a few weeks [*cf.* **26** 131] ; these can withstand dry conditions for many months, and hatch immediately when supplied with moisture. Newly hatched larvae survived for several weeks without food, and for 100 days when completely submerged in water. Complete mortality of the larvae in the soil was given by a 25 per cent. emulsion of ethylene dichloride at the rate of 1 U.S. gal. per square yard ; dusting the foliage with calcium arsenate kills many adults. Of 574 varieties and hybrids of spring wheat tested in Indiana for resistance to the Hessian fly [*Mayetiola destructor*, Say], 91 that showed evidence of resistance have been reserved for further work. The percentage of sugar-cane joints injured by the sugar-cane borer [*Diatraea saccharalis*, F.] increased from 8·7 in 1936 to 16·5 in 1937. A New Guinea variety of sugar-cane that may be of value in breeding a resistant strain has recently been introduced. In tests with cryolite dusts, untreated plots contained 8–10 times as many borers as treated ones. Recovery was made of a Tachinid parasite introduced from Cuba and released in Louisiana in 1936.

A mixture of ethylene dichloride and carbon tetrachloride (3 : 1) was found as toxic as chloropicrin to the adults and larvae of flour beetles [*Tribolium*] in stored flour, and more toxic to the eggs. Fumigation of rough stored rice with hydrocyanic acid gas at the rate of $1\frac{3}{4}$ lb. liquid HCN per 1,000 cu. ft. of space for 72 hours at 80°F. killed all the insects in it. Atmospheric fumigation of clean rice with HCN is not effective, because the outer parts of the mass absorb much of the gas. All insects in it were destroyed, however, by spraying the grain stream with liquid HCN as it passed into the containers.

Experiments in eastern Washington showed that soil can be fumigated there with crude naphthalene for the control of wireworms from mid-May. Examination in 1937 of a field planted with potatoes and onions after having been under lucerne for 5 years showed that the wireworm population had decreased from 8 per sq. ft., before the lucerne was planted, to about 1, and the damage to the two crops was

about 4 and 11 per cent., respectively. Aqueous solutions of dichloroethyl ether applied at concentrations of 6, 9 and 12 cc. per U.S. gal. to tomato, maize, cabbage and potato in California killed 67–100 per cent. of the wireworms, and did not injure the plants, except when the strongest solution was applied at the rate of 1 U.S. gal. per plant.

Cryolite and cuprous cyanide, both as sprays and dusts, were again the best stomach poisons against the pinworm [*Phthorimaea lycopersicella*, Busck] on tomato in California [*cf.* **26** 327] and protected treated plants for approximately 60 days after the last treatment. Field tests indicated that two applications were sufficient for light infestations, whereas severe infestations required five. The first application should be made when the larvae begin to fold the leaves. In studies on the control of *Heliothis armigera*, Hb. (*obsoleta*, F.) on tomato in California, a dust consisting of equal parts by weight of cryolite and talc was the most effective insecticide ; sprays of cryolite (4 lb. per 100 U.S. gals. water) with an adhesive or thiodiphenylamine (3 lb. per 100 U.S. gals.) gave fairly satisfactory results. The best control was given by these insecticides when three applications were made, the first, at the rate of 10 lb. per acre, when the foliage was 1 ft. across, and the other two, at the rates of 20 and 30 lb., respectively, at fortnightly intervals. Three applications of a bait mixture of 1 lb. cryolite or lead arsenate and 25 lb. maize meal scattered lightly and evenly over the leaves of the plants by hand at the same intervals, at the rate of 40 lb. per acre for the first and second applications, and 60–70 lb. for the third, gave approximately the same degree of control.

In investigations on the bionomics of the sweet-potato weevil [*Cylas formicarius*, F.] in Louisiana during 1937–38, adults given the choice of young sweet-potato plants and sweet-potato tubers fed and oviposited on the latter. In field cages in two widely separated districts, some adults lived for 118 and 86 days without food between late November and late March. In cages over green sweet-potato plants some lived for 92 days ; protection from rainfall had little effect on adult survival. Adults emerged in March from decayed sweet potatoes that had been left on the surface of the soil since the previous harvest. Satisfactory results were obtained by fumigating tubers stored in houses, bins or banks with paradichlorobenzene, when the method was properly carried out. Work begun in Alabama, Georgia, Louisiana, Mississippi and Texas in 1937 was designed to eradicate the weevil from areas of commercial production where wild food-plants do not grow perpetually, to prevent spread to uninfested areas and to maintain eradication work already done. In these states, 172 counties were surveyed, and 2,555 infested properties were discovered in 33 counties. Eradication measures included the destruction of infested seed beds, self-sown sweet-potato plants on infested properties and adjoining ones, and wild food-plants (*Ipomoea littoralis* and *I. pescaprae*), and the cleaning of infested fields and stores.

During 1934–35, 20 liberations of *Bigonicheta setipennis*, Fall., a Tachinid parasite of *Forficula auricularia*, L., were made in Washington, Idaho and Oregon, and recovery collections at the end of 1937 indicated that it had survived at or near 15 of the liberation sites, even where the original number of adults liberated was as low as 10–15.

Experiments against caterpillars attacking cabbage in South Carolina in autumn and winter, which comprised the cabbage looper [*Plusia brassicae*, Riley] and Agrotines (chiefly *Heliothis armigera* and climbing cutworms), showed that control can be effected by an

application of a dust mixture containing calcium arsenate and hydrated lime (5 : 1) before head formation, followed by applications of a pyrethrum-talc mixture (0·3 per cent. total pyrethrins) or a derris-clay mixture (1·0 per cent. rotenone) at 10-day intervals after head formation. The pyrethrum and derris dusts were the more effective against *P. brassicae*, and the calcium arsenate dusts against the Agrotines. A dust mixture containing sulphur and hydrated lime applied to strawberry to control the strawberry weevil [*Anthonomus signatus*, Say] resulted in less injury to the flower buds and an increase in marketable fruit. Satisfactory control of the raspberry fruitworm [*Byturus unicolor*, Say] was obtained in Washington by three timely applications of dusts or sprays containing rotenone, the sprays being in general the more effective.

In tests carried out in areas where flue-cured tobacco is grown on methods of protecting newly set plants from *Epitrix parvula*, F. [*cf.* **27** 254], treatments with arsenicals in the plant bed and again after transplanting proved of value. Hibernation studies in North Carolina showed that more beetles were present in old undisturbed tobacco fields than in grass or in the narrow strips bordering adjacent woods. In the tobacco fields, most beetles were found near old tobacco stalks. Against tobacco hornworms [*Protoparce*], which became abundant in North and South Carolina during the latter part of the season, cryolite, either as a spray or as a dust containing not less than 80 per cent. sodium fluoaluminate, was effective. Experiments in Tennessee indicated that injury to tobacco by *Crambus caliginosellus*, Clem., can be considerably reduced by dipping the roots and stalks, before transplanting, in a liquid mixture containing enough cryolite to provide 1·9 per cent. sodium fluoaluminate and an adhesive, and that the control thus effected is superior to that afforded by Paris green baits. Fish-oil, mineral oil, animal glue and billposter's paste at rates of 1·6, 1·6, 0·37, and 0·75 per cent., respectively, were equally effective as adhesives. Pyrethrum dusts containing a high percentage of pyrethrins were slightly more effective in controlling adults of the cigarette beetle [*Lasioderma serricorne*, L.] in open tobacco warehouses in Virginia than dusts containing rotenone, but did not afford economic control.

In tests in Maryland with free nicotine, nicotine sulphate, alcoholic extract of pyrethrum, hellebore powder and derris powder applied as drenches against *Sciara* spp. on mushrooms, the best yields followed the use of free nicotine or pyrethrum extract. Mushrooms treated with nicotine contained traces varying from 0·009 to 0·222 grain nicotine per lb.; the higher content (which is equivalent to about 32 parts per million [*cf.* **26** 328]) occurred in mushrooms picked while still wet from the drench, and 8–10 days after treatment little or no nicotine was present.

The boll weevil [*Anthonomus grandis*, Boh.] caused little damage during 1937, except in Virginia, North and South Carolina and Georgia, where the average amount of damage was approached. Further studies of the effect on the soil of applications of calcium arsenate continued for several years [*cf.* **26** 328, etc.] showed that cotton and maize were not materially affected, but the yield of certain leguminous crops and, in some cases, oats was seriously reduced. In tests on the proportions of sulphur and arsenicals that afford the best control of *Psallus seriatus*, Reut., in Texas, a mixture of calcium arsenate and sulphur (1 : 2) gave the greatest increase in yield, the

average gain in seed cotton per acre being 277 lb. as compared with 230 lb. for fields dusted with sulphur alone [*cf.* **27** 244]. Of 30,610 eggs of *Psallus* collected during the year, 18·7 per cent. were parasitised by *Erythmelus psallidis*, Gah., and 13·2 per cent. by *Anaphes anomocerus*, Gir. The former overwinters in the eggs of its host, but the latter apparently does not. Dusts consisting of sulphur and mixtures of calcium arsenate and sulphur (1 : 2) and of Paris green and sulphur (1 : 9), applied in Arizona to control unnamed Rhynchota on cotton, gave increased yields of 55, 100 and 117 per cent., respectively, and the lint from treated plots was less stained. Cotton is not the preferred food-plant of these bugs; lucerne, sugar-beet grown for seed, *Sorghum* and desert vegetation are the principal sources of infestation.

Work on the biological control of the pink bollworm [*Platyedra gossypiella*, Saund.] was continued. A consignment of a Korean parasite, *Microbracon nigrorufum*, Cushm., was received in 1938, and large numbers are being reared for liberation. Other parasites of *Platyedra* that were collected in Korea and shipped to the United States in 1938 were *M.* (*Habrobracon*) *pectinophorae*, Watanabe, *Chelonus pectinophorae*, Cushm., and *Pristomerus* sp. Bollworm survival was decreased by heavy winter pasturage of the cotton fields and by early winter burial of infested bolls followed by winter irrigation. The decrease in survival was much less when the winter irrigation was omitted, and early burial then gave better results than late. Light outbreaks were discovered in the Santa Cruz Valley and Pinal County, Arizona, which have been free for several years; infestation spread generally in the regulated areas, and the degree of infestation increased in the Pecos Valley in both Texas and New Mexico.

In over 88,000 *Thurberia* bolls collected from several mountain ranges in southern Arizona, only one example of *Platyedra* was found. In the lower Rio Grande Valley, cotton plants are seldom killed by frost and usually produce enough fruit to maintain the bollworm throughout the year. Regulations providing for the destruction of cotton stalks after harvest and not later than 1st October have therefore been issued. In the Big Bend area of Texas, control measures to be carried out included cutting, stacking and burning cotton stalks before 1st October 1938, the stalks to be stacked on the day they were cut and burned when they were sufficiently dry; cleaning thoroughly all storage places for cotton and cotton products; and delaying spring planting till 1st May 1939.

Of 44 varieties of cotton examined during investigations into the possibility of raising a strain resistant to insect attack, those producing bolls of medium thickness were more resistant to *Anthonomus grandis* than those with bolls having either thick or thin walls.

Parasites imported into the United States from Europe during the year were: *Trichacis remulus*, Wlk., against *Mayetiola destructor*; *Phaeogenes nigridens*, Wesm., against *Pyrausta nubilalis*, Hb.; *Microbracon piger*, Wesm., and *Phanerotoma planifrons*, Nees, against the lima bean pod borer [*Etiella zinckenella*, Treitschke]; and *Triaspis thoracicus*, Curt., against the pea Bruchid, *Bruchus pisorum*, L., and the vetch Bruchid [*Bruchus brachialis*, Fhs.]. Those imported from Canada were: *Chelonus annulipes*, Wesm., against *Pyrausta nubilalis*; *Collyria calcitrator*, Grav., against the black stem sawfly [*Trachelus tabidus*, F.]; and *Microplectron fuscipenne*, Zett., *Exenterus abruptorius*, Thnb., *E. adspersus*, Htg., and *Microcryptus* sp. against the

European spruce sawfly [*Diprion polytomum*, Htg.]. *Gambrus stokesi*, Cam., was imported from Australia against *Cydia molesta*. Insects imported into Porto Rico included : *Phanerotoma planifrons*, Nees, against *Etiella zinckenella* ; *Chelonus annulipes* (from the United States) against *Diatraea saccharalis* ; and *Coelophora inaequalis*, F., and *Scymnodes* (*Platyomus*) *lividigaster*, Muls. (from Hawaii) against the yellow sugar-cane Aphid [*Sipha flava*, Forbes]. A list is given of parasites and predators shipped to foreign countries.

Chemical investigations on insecticides and the removal of spray residues are briefly reviewed.

HARTNACK (H.). **202 Common Household Pests of North America.**—La. Cr. 8vo, 320 pp. illus. Chicago, Ill., Hartnack Pubg Co., 1939. Price $3·75 plus postage.

In this eminently readable book, which is planned and illustrated in an original manner, the author has collected information on household pests in the United States, at present scattered throughout the literature, for the use of those who desire to know more about them than is contained in government and state leaflets. The main part (pp. 45–271), which deals with the bionomics and control of Arthropod pests, is preceded by notes on classification and on mammal and bird pests, and is followed by sections on pests that feed on keratin (of which hair, wool and feathers are largely composed), and those that infest garbage chutes and incinerators. The remainder of the book contains discussions on miscellaneous subjects, including the dangers of inadequate dissemination of information on the risks associated with the use of fumigants and insecticides poisonous to man, the responsibility of federal and state governments in this respect (particularly when fatalities may occur), with suggestions for minimising such risks, and the desirability of employing original illustrations in entomological publications and acknowledging the sources of illustrations that are not original.

CHAPMAN (P. J.) **The Plum Curculio as an Apple Pest.**—*Bull. N. Y. St. agric. Exp. Sta.* no. 684, 75 pp., 34 figs., 30 refs. Geneva, N.Y., 1938.

An account, based on observations carried out in the period 1931-34, mainly in the Hudson Valley, New York, is given of the life-history and control of the plum curculio, *Conotrachelus nenuphar*, Hbst., on apple. All stages of the weevil are described, and the history of its occurrence in the United States and Canada and its distribution and food-plants there are given.

The following is based on the author's summary and conclusions : The adults overwinter in débris on the ground in or near orchards ; their migration to the trees starts during blossoming and continues for 4–5 weeks, usually reaching a peak 10–14 days after petal fall. They feed and oviposit on the fruits from the time they begin to form until they reach a diameter of about 1½ ins., making small, irregular feeding punctures and crescent-shaped oviposition marks. Larval development is completed in fruits that drop prematurely in June and July, and infestation is one of the factors causing them to fall ; except in early varieties, larvae rarely, if ever, complete their development in

apples that remain on the tree. The larvae pupate in the soil at a depth of about an inch. The adults emerge principally in August, and hibernate after feeding on the fruit for a short time. The egg stage averaged a week, and the periods spent as a larva in the fruit, and as a larva, pupa and newly emerged adult in the soil averaged 16 and 30 days, respectively.

The weevils tend to concentrate at the edges of orchards, especially where they are large or cultivated. Trees in the same orchard bearing light, moderate and heavy crops were found to sustain approximately the same percentage injury. No considerable migration of overwintered adults to the apple trees takes place until the temperature after the blossom period either reaches a maximum of 75°F. or averages at least 60°F. for two consecutive days.

Field tests of sprays confirmed the value against the weevil of three applications of lead arsenate [*cf. R.A.E.*, A **20** 360]. Lead and calcium arsenates were about equal in efficiency, and were the most effective insecticides, giving 90 per cent. or more control when a complete schedule was followed. A cubé spray was less effective than one of cryolite, and compounds of nicotine gave essentially negative results. Residues of lime-sulphur and perhaps also of similar non-insecticides occurring in spray mixtures give some protection, presumably through repellence. Three applications of lead arsenate and sulphur (1 : 9) proved inferior to the three standard lead-arsenate sprays. Adhesives such as fish-oil (1 pint per 100 gals.) only slightly increased the efficacy of lead arsenate.

GROVES (K.), MARSHALL (James) & FALLSCHEER (H.). **The Injection of Spray Concentrates.—A New Procedure for the Application of Insecticides.**—*Bull. Wash. agric. Exp. Sta.* no. 367, 12 pp., 3 figs., 1 ref. Pullman, Wash., 1938.

The following is based on the authors' summary : A new method of applying spray mixtures, involving the use of spray chemicals in the form of a ready-mixed concentrate and the injection of such a concentrate into the suction line of a high-pressure spray pump, has been devised. The apparatus by which the concentrate is injected at a constant ratio to the flow of water through the spray pump is described. The advantages of using it are : full utilisation of the principle of inversion with decreased dosage of lead arsenate or cryolite [*cf. R.A.E.*, A **26** 174, etc.] ; elimination of the spray tank (if an irrigation hydrant is available) and the agitation of the finished spray mixture ; increased accuracy of application by metered flow ; saving in the labour required to attend the spray pump ; and the possibility of using ready-mixed spray concentrates.

CURRIE (J. H.). **Steam kills over-wintering Larvae.**—*Bett. Fruit* **33** no. 8 p. 6, 1 fig. Portland, Ore., 1939.

The use of trap bands against overwintering larvae of the codling moth [*Cydia pomonella*, L.] on pear trees is hindered by the difficulty of scraping off the tough corky bark. In northern California, it was found that 80 per cent. of the larvae in cracks in the trunks and large branches of pear trees, and also those in rubbish or on fence posts and boxes, could be killed with sprays of steam from a portable boiler. This treatment does not damage the trees and may possibly be useful

on apple trees, but should not be applied to smooth-barked patches on the branches or to young trees.

The necessary apparatus consists of a flash boiler capable of producing 75–100 lb. pressure and dealing with at least 70 U.S. gals. water per hour, a small fuel tank, a water tank with a capacity of at least 200 U.S. gals., water pumps and a burner fan driven by a $\frac{1}{4}$–$\frac{1}{2}$ H.P. petrol engine. Two 50-ft. lengths of $\frac{1}{2}$-in. 4-ply steam hose are attached to the outlet pipe, which is taken from the lower part of the boiler. The spray rods, which are insulated for the protection of the operators, are usually 4–5 ft. lengths of $\frac{3}{8}$-in. pipe, curved to an angle of 45° at the tip, and with a $\frac{1}{4}$-in. discharge opening made of copper tubing. The equipment is mounted on skids and placed on a truck or tractor-drawn trailer, and requires about 2 U.S. gals. fuel and 40–70 U.S. gals. water per hour. A wet steam should be used, and the nozzle should be moved slowly and at an even distance of about an inch from the bark of the tree.

Emerson (A. E.). **Report of two Cases of Introduction of** *Coptotermes*. —2 pp. multigraph. Chicago, Dept. Zool. Univ. Chicago, 1939.

Coptotermes remotus, Silv., which was described from Simonstown, Cape Province, South Africa in 1927 (the name being preoccupied by *Coptotermes remotus*, Hill, described earlier in the same year), has been found to be a synonym of *C. formosanus*, Shir., a species of economic importance that occurs in eastern Asia and Hawaii. References to papers dealing with its distribution in relation to climate [*cf. R.A.E.*, A **25** 592] are given as a source of data for ascertaining its potential spread in South Africa.

The author has received from Jamaica specimens of *Coptotermes javanicus*, Kemner, which was previously known only from Java. The only species of the genus previously recorded from the West Indies are *C. testaceus*, L., from Trinidad, Tobago and Grenada, and an unidentified species from Barbados [*cf.* **27** 55, 56].

Turner (P. E.) & Charter (C. F.). **A preliminary Survey of Soil Types of Sugar Estates of Trinidad with special Reference to the Allocation of Sugar-cane Varieties.**—73 pp., 33 figs., 1 fldg. map, many refs. Port-of-Spain, Trinidad Sugar-cane Investigation Comm., 1939.

In this survey, the distribution of varieties of cane on sugar estates in Trinidad is reviewed, the more important types of soil are described and classified, and grouped on the basis of certain of their more important agricultural factors, and recommendations are made as to the general suitability of the soil groups to noble or hardy varieties or to hybrids of the two.

There is some evidence that the liability of sugar-cane to attack by froghoppers [*Tomaspis saccharina*, Dist.] is dependent on the suitability of the soil for oviposition, and its recovery from damage on the fertility of the soil, with special reference to lime-status, on natural drainage and on the capacity of the soil to supply moisture during rainless periods. A tentative classification of soils in relation to attack by *T. saccharina* and subsequent froghopper blight is given.

Memoria de la Estación experimental de La Molina correspondiente al año 1937. [Report of the La Molina Experiment Station for 1937.]—*Mem. Estac. exp. agric. Minist. Fom. Peru* no. 10 281 pp., illus. Lima, 1938.

This publication includes a report by the chief entomologist, J. E. Wille (pp. 175–202) and a note by J. M. Lamas C. (pp. 203–205) on the establishment of a station for work on cotton insects in the northern valleys of Peru, where the chief pests to be studied are species of *Dysdercus*. Most of the pests recorded in the main report have been noticed from previous ones [*R.A.E.*, A **27** 164, etc.]. In April, there was an unusually severe infestation of cotton by *Mescinia peruella*, Schaus, and stress is laid on the need for abundant early irrigation to advance the ripening of the bolls, as green bolls are the ones most attacked. An unexpected outbreak of *Heliothis virescens*, F., and *H. armigera*, Hb. (*obsoleta*, F.) occurred in cotton plantations on sandy soil.

Lal (K. B.). **The First Record of the Eulophid Genus *Azotus* from India (Chalcidoidea : Hymenoptera).**—*Rec. Indian Mus.* **40** pt. 1 pp. 1–4, 1 fig., 5 refs. Calcutta, 1938.

The Aphelinid, *Azotus delhiensis*, sp. n., is described from adults of both sexes reared from nymphs of *Aleurolobus barodensis*, Mask., infesting sugar-cane near Delhi. No species of this genus has previously been recorded from India or from any host other than Coccids, but cases in which two of the species may have been hyperparasites have been reported [*R.A.E.*, A **14** 580 ; **16** 436].

Hafiz (H. A.). **On two Chalcidoid Parasites of Lepidoptera with a Description of *Eupelmus terminaliae*, sp. nov.**—*Rec. Indian Mus.* **40** pt. 1 pp. 121–122, 1 ref. Calcutta, 1938.

Eupelmus terminaliae, sp. n., is described from adults of both sexes found in a breeding cage containing eggs of a Lasiocampid collected on leaves of *Terminalia catappa* in Calcutta. A single adult of the Chalcid, *Brachymeria euploeae*, Westw., together with adults of *Virachola isocrates*, F., was found in a cage containing pomegranate fruits that had been infested by larvae of this Lycaenid in Bengal.

Schneider (F.). **Ein Vergleich von Urwald und Monokultur in bezug auf ihre Gefährdung durch phytophage Insekten, auf Grund einiger Beobachtungen an der Ostküste von Sumatra.** [A Comparison, based on some Observations on the East Coast of Sumatra, between primeval Forest and Monoculture as regards their Peril from Insect Pests.]—*Schweiz. Z. Forstwesen* 1939 nos. 2–3 repr. 22 pp., 11 figs. Berne, 1939.

The author discusses the conditions obtaining in tropical forests as regards the ecology of leaf-eating Lepidoptera and describes observations in a plantation of gambier (*Uncaria gambir*), on the east coast of Sumatra, on the bionomics of the Drepanid, *Areta carnea*, Btlr., which is one of the principal leaf-eating pests of gambier, and of its Chalcid parasite, *Brachymeria euploeae*, Westw. The young larvae of the Drepanid skeletonise the leaf tips, and the older ones eat the entire leaves, except for a small part of the midrib. Pupation takes place in a cocoon in a rolled leaf. As the average time required for total development is only 36 days and there are about 10 generations

a year, outbreaks can develop suddenly, and plantations may be entirely defoliated unless the plants are sprayed with lead arsenate. Temperature varies little throughout the year, and, although on the east coast there is no definite rainy season, precipitation reaches a peak in October and November. The quality of the leaves can be so affected by prolonged dry weather that larvae of *O. carnea* cannot feed on them, while a continued rainy period may result in a mass increase of infestation. The chief injury occurs in the centre of a plantation, where a lead arsenate spray must be applied twice a year to prevent defoliation. One application is sufficient in the immediately surrounding areas, while at the edges bordering on the forest no spraying is needed, since here the Drepanid is more exposed to the action of parasites, chiefly *B. euploeae*, and predators, of which the most important is the Pentatomid, *Cantheconidea acuta*, Vollen. Furthermore, ovipositing females migrate by flying, and thus the marginal areas become depleted if there are no new immigrants from the forest.

It was found that adults of *B. euploeae*, which parasitises the pupae, lived longer if supplied with sugary food, and its action was increased when a permanent stand of various nectar-yielding plants with extrafloral nectaries was established. In spite of this, however, it failed to check an outbreak after the maximum rainfall. The females oviposit only in hosts in a suitable developmental stage, and their perception of the host pupae extends only to a distance of 4–12 inches. The mathematical probability of parasitism is discussed, together with the factors involved. It is considered that in the primeval forest, each species of plant is attacked by a complex of insects, each of which is checked by parasites and predators that do not depend on one species of host. The parasite population depends on the sum of the population densities of all the hosts, and the population density of any one host is merely a fraction of the critical density in this respect. If a forest plant is removed from its natural association and planted in monoculture, only a few phytophagous insects, and also only a few of their parasites, can exist under the new conditions. Monoculture creates a labile biocoenosis, which can be maintained only by continual application of control measures; in their absence, the gambier plantations would revert to forest or, if humus is lacking, become a lalang grass steppe.

[Nefedov (N. I.).] **Нефедов (Н. И.). Contribution to the Ecology of Acrididae of the Troitsk Horse-breeding State Farm.** [*In Russian.*] —*Bull. Inst. Rech. biol. Perm* **11** fasc. 7–8 pp. 185–192, 19 refs. Perm, 1938. (With a Summary in English.)

Quantitative studies on the grasshopper populations of three different habitats in the pastures and cultivated lands of the Troitzk State Farm, southern Ural Province, were carried out in the summer of 1932 by means of sample sweepings. The most numerous species were *Dociostaurus crucigerus brevicollis*, Ev., *Chorthippus biguttulus*, L., *C. apricarius*, L., *C. albomarginatus*, DeG., and *Omocestus haemorrhoidalis*, Charp. The distribution of species by habitats is discussed, and it is concluded that it is determined not by microclimatic differences, but mainly by the presence or absence of preferred food-plants. *D. crucigerus brevicollis* and *Pararcyptera* (*Arcyptera*) *microptera*, F. W., proved to have migratory habits, and the adults spread from the breeding places to other habitats.

Lea (A.) & Webb (D. van V.). **Field Observations on the Red Locust at Lake Rukwa in 1936 and 1937.**—*Sci. Bull. Dep. Agric. S. Afr.* no. 189, 81 pp., 20 figs., 10 refs. Pretoria, 1939. Price 6*d*.

The behaviour of *Nomadacris septemfasciata*, Serv., was studied in relation to the environment in the outbreak centres of Lake Rukwa, Tanganyika [*cf. R.A.E.*, A **21** 671 ; **26** 683], in order to discover the factors responsible for phase transformation. Population densities and concentrations were studied by means of regular counts on experimental plots, by traverses and by direct observations. A general description of the relief, drainage, climate and vegetation of the Lake Rukwa outbreak area is given. The results of climatic observations are tabulated, and the relation of the life-cycle to climatic conditions is illustrated by a bioclimatograph.

The events observed in 1936 and 1937 were a continuation of a decline in a swarming cycle. In 1936, the colour of hoppers ranged from green to that of phase *gregaria*, which constituted 50 per cent. of the hoppers during the last instars, but the young adults were of the normal coloration of phase *solitaria*. In 1937, some hoppers again had the coloration of phase *gregaria*, but the percentage of them decreased with age. In outdoor cages, green grass and moist conditions produced green coloration in hoppers [*cf.* **20** 672] and retarded sexual maturation in adults ; exposed conditions favoured the production of *gregaria* coloration. It is concluded that the coloration of hoppers is not a reliable index of the phase.

A biometrical study of adults showed that the populations in 1936 and 1937 varied strikingly towards the solitary phase, and were significantly different from the *dissocians* population observed at Lake Rukwa in 1935. The elytron/femur ratio is the finer measure of local variations in a population, while sexual dimorphism expressed by the ratio of wing length of female over wing length of male is the better index of seasonal differences ; it is probably also a better index of phase variation, for it is more easily discernible in the field.

The most obvious natural enemies of *N. septemfasciata* were various birds, but a Meloid, *Mylabris dicincta*, Bertol., was very numerous on the Rukwa plain and is suspected of parasitising the eggs.

In the outbreak centres of Milepa and Kalumbaleza, situated at the shallow north-western end of the lake, the latter is surrounded by a succession of grassland belts liable to periodical flooding. They consist of a uniform *Diplachne* zone around the mud belt, succeeded by a *Cyperus-Cynodon* zone lying on slightly higher ground, in which fresh-water channels are overgrown by *Echinochloa pyramidalis*, and by a *Chloris* zone on still higher ground ; a *Hyparrhenia* zone lies between the latter and the bush and tree fringe. In other parts of the Rukwa area, the plain is narrower, owing to a steeper slope, and the two intermediate zones are either much reduced or absent.

In February 1936, young hoppers were present over the *Diplachne* and *Cyperus-Cynodon* zones, suggesting that eggs had been deposited over a wide area. They were in small bands, which were not mutually attracted, and moved about at random. As they grew older, the bands disintegrated, but there was a concerted movement on the part of separate individuals into the *Cynodon-Cyperus* zone, where they became concentrated in clumps of *Echinochloa*, on which the majority accomplished their final moult. The movement away from the rising lake was continued by the young adults in May–June, when they

became concentrated in the *Hyparrhenia* zone. From July onwards, with the retreat of floods, there was a distinct movement back towards the *Cynodon-Cyperus* zone, particularly to green clumps of *Echinochloa* and *Aeschynomene*, on which the locusts became densely concentrated by October. One of such concentrations covered an area of up to a mile long and 500 yards wide, but the coloration and behaviour of the locusts in it remained those of phase *solitaria*. This shifting of population may have been caused by the rapid desiccation of the plain during the later half of the dry season, and by grass fires. Signs of sexual maturation appeared in November, during which there were spontaneous flights of more or less distinct very small swarms, but when rains broke in December and humid conditions became universal, the locusts scattered and oviposited all over the *Hyparrhenia* and *Chloris* zones and the higher parts of the *Cynodon-Cyperus* zone, where hoppers emerged in January 1937. These were less numerous than in 1936, and the small groups resulting from emergence from single egg-pods disintegrated soon after hatching. There was some movement of the population towards the lake and *Echinochloa* swamps, in the direction opposite to that of the hopper migration in 1936. The young adults were not concentrated to any extent by May 1937.

It is concluded that islands of taller vegetation serve as refuges and sites of concentration, and the proportion to them of relatively short and uniform vegetation is probably very important in determining the extent of migration and concentration, which, when it occurs in the hopper stage, must be of vital importance in the process of transformation. The absolute size of the plain may be of importance, for the degree of concentration in tall grass will depend on the size of the area covered by less attractive short grass ; again, increased activity required to traverse greater distances may be a favourable factor.

In 1936 and 1937, the factors of migration and concentration were probably favourable to swarming, but phase *gregaria* was not produced because the hopper population was too small, probably owing to destruction of eggs by flooding. Further studies are required of the effect on population fluctuations, migrations and concentrations of changes in vegetation due to different degrees of flooding and grass burning.

The distribution of locusts and their biometrical comparison suggest that there is a migration of phase *solitaria* between the Rukwa plain and Ufipa plateau, similar to that observed for swarms in this area and similar country in Nyasaland [*cf.* **21** 671 ; **24** 230]. No breeding was observed on the Ufipa plateau, where locusts were found only in the dry season and where they were most numerous near the edge of the escarpment overlooking the Rukwa plain. The upward migration must have taken place singly ; occasional locusts may have been caught in hot upward currents. The return migration may have been a directed movement following a temperature gradient. It is essential to determine the effect of such migrations on the fluctuations of populations on the Rukwa plain.

WALLACE (G. B.). **Plant Diseases spread by Bugs.**—*E. Afr. agric. J.* **4** no. 4 pp. 268–271. Nairobi, 1939.

A list is given of the numerous plants of which the fruits are attacked by one or more of the five fungi of the genus *Nematospora* and allied

genera that are known to be transmitted by Heteroptera. It shows which of the fungi have been recorded from each and the localities concerned. The genera of bugs in which one or more species have been recorded as vectors in different countries are *Antestia, Calidea, Dysdercus, Leptoglossus, Nezara, Odontopus* and *Phthia*. The symptoms caused in cotton bolls and the seeds of coffee and beans are briefly described, and the conditions under which damage is likely to be severe are enumerated.

Pescott (R. T. M.). **Incidence of Potato Moth. Survey of Victorian Districts.**—*J. Dep. Agric. Vict.* **37** pt. 1 pp. 15–24, 12 figs. Melbourne, 1939.

Phthorimaea operculella, Zell., is the most important insect pest of potatoes in Victoria, but its incidence is greatly affected by seasonal conditions during the growing period of the crop, a hot dry season, such as those experienced in 1935–36 and 1937–38 being very favourable to its rapid increase. An account is given of its bionomics and the types of injury for which it is responsible, to introduce a report on the results of a survey of all the larger potato-producing areas of the state to ascertain the extent of the damage caused in 1937–38. In the most severely infested district, the damage represented a loss of 30–40 per cent. of the crop. Losses of 20 per cent. or over occurred in several districts; they were much smaller in others, chiefly where rainfall was normal during the growing season. Particular attention is devoted to one district in which 10,000–11,000 acres of potatoes were planted and the average loss for all varieties was 20–25 per cent., losses for early varieties being much greater, in one instance 90 per cent., partly as a result of heavy infestation of the growing tops during November. The relation of certain field practices to infestation and severe damage is considered. Practices of which the general use might have reduced losses in spite of the unfavourable weather include thorough preparation of the soil by early deep ploughing, followed by the broadcasting of a green crop ploughed in sufficiently early to allow it to rot before the planting of the potatoes; planting at a depth of not less than 4–5 ins.; earthing up well; sewing up the bags as soon as possible after filling and, if immediate removal is impossible, inverting them so that the sewn end is in the ground; collecting and burning tops every evening; sorting rejected potatoes immediately and, if it is intended to sell or use the residue as food for stock, doing so immediately; and keeping the potato fields clear of weeds, particularly the black nightshade (*Solanum nigrum*), an important food-plant of *P. operculella*. The practice of placing a pile of potato haulms on top of the bags either before or after sewing should be discontinued, as they harbour larvae that fall or migrate into the bags.

Pescott (R. T. M.) & Hogan (T. W.). **Cutworms.**—*J. Dep. Agric. Vict.* **37** pt. 1 pp. 37–39, 5 figs. Melbourne, 1939.

Of the three cutworms common in Victoria, *Persectania ewingi*, Westw., and *Cirphis unipuncta*, Haw., chiefly attack grasslands and cereal crops, while *Heliothis armigera*, Hb., attacks maize, potatoes, tomatos, tobacco, etc. Practically all food crops, and even fruit trees are, however, liable to damage. The standard method of control is

the use of a bait of 1 lb. Paris green and 24 lb. bran moistened with a solution of 8 oz. salt in 3 gals. water. It is rendered more attractive by the addition of 6 crushed lemons. If Paris green is not available, 12 oz. sodium arsenite may be used in the bait, but it is then less effective. The bait is scattered in late afternoon over an infested area or between the rows of a crop, or is spread in front of a line of migrating larvae on the surface of the soil or in furrows made with the steep side facing the larvae.

Cutworm control on tobacco is now a routine measure in Victoria ; mixtures of lead arsenate and pollard (1 : 15) or Paris green and pollard (1 : 35) are applied to the plants by means of a finely perforated tin immediately after transplanting and at fortnightly intervals until topping time. Young tomato plants should be dipped in a lead arsenate suspension (1 oz. paste to 1 gal. water) on transplanting and then regularly sprayed with lead arsenate at the same concentration or dusted with 50 per cent. lead arsenate dust. Chemical methods of control on lucerne are usually impracticable ; infested crops should be cut as soon as possible and the cutworms present destroyed. The young fruit on apple and pear trees may be protected by increasing the strength of the sprays applied against the codling moth [*Cydia pomonella*, L.] from 5 lb. to 8 lb. lead arsenate paste in 80 gals. water.

The elimination of weeds under which the spring eggs may be deposited is an important factor in reducing damage by cutworms.

COUTURIER (A.). **Sur la présence de** *Ceresa bubalus* **Fab. dans le Sud-Ouest de la France (Hem. Membracidae).**—*Bull. Soc. ent. Fr.* **43** no. 15–16 pp. 211–212, 7 refs. Paris, 1938.

Ceresa bubalus, L., a Membracid that causes damage to fruit trees by making incisions in the branches for oviposition, has been recorded from various parts of France [*R.A.E.*, A **26** 343, etc.], but not from the south-west, though the author observed it there as long ago as 1932. It has since been found in several localities in four departments, a list of which is given. It is common in gardens and in damp places covered with vegetation. Many oviposition scars were found on apple trees in January 1938, and the insect was successfully reared in the laboratory on broad beans, potato and willow (*Salix purpurea*). At Bordeaux, the eggs hatched between the end of April and the end of May 1938, the adults appeared in July, and oviposition began in early August and was still continuing in October. There is only one generation in the year.

SALT (G.). **Further Notes on** *Trichogramma semblidis*.—*Parasitology* **30** no. 4 pp. 511–522, 3 figs., 4 refs. London, 1939.

The following is based on the author's summary of further studies [*cf. R.A.E.*, A **26** 102] on *Trichogramma semblidis*, Auriv., an egg parasite of *Sialis lutaria*, L., in England. This parasite is distinguished from *T. evanescens*, Westw., by various differences in behaviour and physiology. It oviposits in the egg-masses, but rarely in separated eggs of *Sialis*, which is a suitable host, and the males emerging from *Sialis* eggs are apterous. *T. evanescens* does not oviposit in egg-masses of *Sialis*, but does so commonly in separated eggs ; *Sialis* is not a suitable host for it, and the few males that emerge are of the ordinary winged form. There are no true intermediates between the two forms (alate

and apterous) of the male in *T. semblidis*, but intermediate types are simulated by degenerate individuals of small size produced by starvation. Among 1,740 males reared from eggs of *Sialis* and 1,847 reared from eggs of moths (*Sitotroga cerealella*, Ol., *Ephestia kuehniella*, Zell., and *Barathra brassicae*, L.), there were only 19 exceptions to the rule that the apterous form emerges from the former and the winged form from the latter. The ability of *T. semblidis* to produce its apterous male can remain latent through as many as 64 generations reared on *Sitotroga* and yet find its full expression as soon as it is reared on *Sialis*. Eggs of several Neuroptera of other genera have been parasitised experimentally, but *Sialis lutaria* remains the only known host that regularly elicits the apterous form.

T. semblidis is capable of arrhenotokous parthenogenesis. The statement that it includes thelytokous strains [**25** 325] requires corroboration.

Thorpe (W. H.) & Caudle (H. B.). **A Study of the Olfactory Responses of Insect Parasites to the Food Plant of their Host.**—*Parasitology* **30** no. 4 pp. 523–528, 5 refs. London, 1939.

The following is substantially the authors' summary : The adults of *Pimpla ruficollis*, Grav., a parasite of the pine-shoot moth, *Rhyacionia* (*Evetria*) *buoliana*, Schiff., in England, emerge a considerable time before young larvae of the host are available for oviposition. Apparently they leave the pine trees during this period and feed on the flowers of certain Umbelliferae and probably other plants. After three or four weeks they return to the pine shoots, which now contain larvae on which they can oviposit.

Olfactometer experiments carried out in 1938 at Cambridge with material obtained from Norfolk indicated that during this first period of adult life the parasites are repelled by the odour of oil of *Pinus sylvestris*. At this time the ovaries are very small and are probably not ready for the production of eggs. After the third or fourth week of life, the females become attracted by the oil of *P. sylvestris*, and the ovaries are then relatively large. Geraniol, which is known to be a constituent of certain conifers, was also tested, but was invariably repellent to the parasites.

Some evidence was obtained that conclusions reached as a result of experiments with *P. ruficollis* apply also to *Eulimneria rufifemur*, Thoms., another parasite of *Rhyacionia* reared from the same material.

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Eckstein (K.). **Das Bohrmehl des Waldgärtners, *Myelophilus piniperda* L., nebst Bemerkungen über den " Frass " der Borkenkäfer und anderer Insekten.** [The Frass and Débris in Galleries of *M. piniperda*, L., with Notes on the Feeding of Bark-beetles and other Insects.]—*Arb. physiol. angew. Ent. Berl.* **6** no. 1 pp. 32–41, 7 figs. Berlin, 1939.

Prashad (B.). **Ueber die angewandte Entomologie in den verschiedenen Ländern.** [On Applied Entomology in various Countries.] **10. Applied Entomology in India.**—*Arb. physiol. angew. Ent. Berl.* **6** no. 1 pp. 66–72. Berlin, 1939.

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Rungs (C.). **Une Diaspine nouvelle du Maroc,** *Hemiberlesea* [*Aspidiotus*] *jourdani*, n. sp. (**Hem. Coccidae**).—*Bull. Soc. ent. Fr.* **43** no. 19–20 pp. 231–234, 1 fig. Paris, 1939.

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Charles (V. K.). **A new entomogenous Fungus** [*Spicaria heliothis*] **on the Corn Earworm** *Heliothis obsoleta* [*H. armigera*, Hb., in the United States].—*Phytopathology* **28** no. 12 pp. 893–897, 3 figs. Lancaster, Pa, 1938.

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Indices to Vol. VI–XVI.

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